SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

*LOUIS AGASSIZ.**

IT would be unnatural to have such an assemblage as this meet in the Museum and Faculty Room of this University and yet have no public word spoken in honor of a name which must be silently present to the minds of all our visitors.

At some near future day it is to be hoped some one of you who is well acquainted with Agassiz's scientific career will discourse here concerning it. I could not now, even if I would, speak to you of that of which you have far more intimate knowledge than I. On this social occasion it has seemed that what Agassiz stood for in the way of character and influence is the more fitting thing to commemorate, and to that agreeable task I have been called. He made an impression that was unrivalled. He left a sort of popular myth—the Agassiz legend, as one might say—behind him in the air about us; and life comes kindlier to all of us; we get more recognition from the world because we call ourselves naturalists—and that was the class to which he also belonged.

The secret of such an extraordinarily effective influence lay in the equally extraordinary mixture of the animal and social gifts, the intellectual powers and the desires and passions of the man. From his

* Words spoken at the reception of the American Society of Naturalists given by the President and Fellows of Harvard College at Cambridge on December 30, 1896.

boyhood he looked on the world as if it and he were made for each other, and on the vast diversity of living things as if he were there with authority to take mental possession of them all. His habit of collecting began in childhood, and during his long life knew no bounds save those that separate the things of nature from those of human art. Already in his student years, in spite of the most stringent poverty, his whole scheme of existence was that of one predestined to greatness, who takes that fact for granted, and stands forth immediately as a scientific leader of men.

His passion for knowing living things was combined with a rapidity of observation and a capacity to recognize them again and remember everything about them, which all his life it seemed an easy triumph and delight for him to exercise, and which never allowed him to waste a moment in doubts about the commensurability of his powers with his tasks. If ever a person lived by faith, he did. When a boy of twenty, with an allowance of two hundred and fifty dollars a year, he maintained an artist attached to his employ, a custom which never afterwards was departed from, except when he maintained two or three. He lectured from the very outset to all those who would hear him. "I feel within myself the strength of a whole generation," he wrote to his father at that time, and launched himself upon the publication of his costly 'Poissons Fossiles' with no clear vision of the quarter from whence the payment might be expected to come.

At Neuchâtel (where between the ages of twenty-five and thirty he enjoyed a stipend that varied from four hundred to six hundred dollars) he organized a regular academy of natural history, with its museum, managing by one expedient or another to employ artists, secretaries and assistants, and to keep a lithographic and printing establishment of his own employed with the work that he put forth. Fishes, fossil and living, echinoderms and glaciers, transfigured themselves under his hand, and at thirty he was already at the zenith of his reputation, recognized by all as one of those naturalists in the unlimited sense, one of those folio copies of mankind, like Linnæus and Cuvier, who aim at nothing less than an acquaintance with the whole of animated nature. His genius for classifying was simply marvellous; and, as his latest biographer says, nowhere had a single person ever given so decisive an impulse to natural history.

Such was the human being who on an October morning fifty years ago disembarked at our port, bringing his hungry heart along with him, his confidence in his destiny, and his imagination full of plans. The only particular resource he was assured of was one course of Lowell Lectures. But of one general resource he always was assured, having always counted on it and never found it to fail—and that was the good will of every fellow-creature in whose presence he could find an opportunity to describe his aims. His belief in these was so intense and unqualified that he could not conceive of others not feeling the furtherance of them to be a duty binding also upon them. *Velle non discitur*, as Seneca says,—Strength of desire must be born with a man; it can't be taught. And Agassiz came before one with such enthusiasm glowing in his countenance—such a persuasion radiating from his person that his projects were the sole things really fit to interest man as man—that he was absolutely irresistible. He came, in Byron's words, with victory beaming from his breast, and every one went down before him, some yielding him money, some time, some specimens and some labor, but all contributing their applause and their godspeed. And so, living among us from month to month and from year to year, with no relation to prudence except his

pertinacious violation of all her usual laws, he on the whole achieved the compass of his desires, studied the geology and fauna of a continent, trained a generation of zoologists, founded one of the chief museums of the world, gave a new impulse to scientific education in America, and died the idol of the public, as well as of his circle of immediate pupils and friends.

The secret of it all was that, while his scientific ideals were an integral part of his being, something that he never forgot or laid aside, so that wherever he went he came forward as 'the Professor,' and talked 'shop' to every person, young or old, great or little, learned or unlearned, with whom he was thrown, he was at the same time so commanding a presence, so curious and inquiring, so responsive and expansive, and so generous and reckless of himself and of his own, that every one said immediately, "Here is no musty *savant*, but a man, a great man, a man on the heroic scale, not to serve whom is avarice and sin." He elevated the popular notion of what a student of Nature could be. Since Benjamin Franklin we had never had among us a person of more popularly impressive type. He did not wait for students to come to him; he made inquiry for promising youthful collectors, and when he heard of one he wrote, inviting and urging him to come. Thus there is hardly one now of the American naturalists of my generation whom Agassiz did not train. Nay, more; he said to every one that a year or two of natural history, studied as he understood it, would give the best training for any kind of mental work. Sometimes he was amusingly *naïf* in this regard, as when he offered to put his whole museum at the disposition of the Emperor of Brazil if he would but come and labor there. And I well remember how certain officials of the Brazilian Empire smiled at the cordiality with which he pressed upon them a similar invitation. But it had a great effect. Natural history must, indeed, be a godlike pursuit, if such a man as this can so adore it, people said; and the very definition and meaning of the word naturalist underwent a favorable alteration in the common mind.

Certain sayings of Agassiz's, as the famous one that he 'had no time for making money,' and his habit of naming his occupation simply as that of 'teacher,' have caught the public fancy and are permanent benefactions. We all enjoy more consideration for the fact that he manifested himself here thus before us in his day.

He was a splendid example of the temperament that looks forward and not backward, and never wastes a moment in regrets for the irrevocable. I had the privilege of admission to his society during the Thayer expedition to Brazil. I well remember at night, as we all swung in our hammocks in the fairy-like moonlight, on the deck of the steamer that throbbed its way up the Amazon between the forests guarding the stream on either side, how he turned and whispered, "James, are you awake?" and continued, "*I* cannot sleep; I am too happy; I keep thinking of these glorious plans." The plans contemplated following the Amazon to its head-waters, and penetrating the Andes in Peru. And yet, when he arrived at the Peruvian frontier and learned that that county had broken into revolution, that his letters to officials would be useless, and that that part of the project must be given up, although he was indeed bitterly chagrined and excited for part of an hour, when the hour had passed over it seemed as if he had quite forgotten the disappointment, so enthusiastically was he occupied already with the new scheme substituted by his active mind.

Agassiz's influence on methods of teaching in our community was prompt and decisive—all the more so that it struck

people's imagination by its very excess. The good old way of committing printed abstractions to memory seems never to have received such a shock as it encountered at his hands. There is probably no public school teacher now in New England who will not tell you how Agassiz used to lock a student up in a room full of turtle shells, or lobster shells or oyster shells, without a book or word to help him, and not let him out till he had discovered all the truths which the objects contained. Some found the truths after weeks and months of lonely sorrow; others never found them. Those who found them were already made into naturalists thereby; the failures were blotted from the book of honor and of life. "Go to nature; take the facts into your own hands; look and see for yourself!" These were the maxims which Agassiz preached wherever he went, and their effect on pedagogy was electric. The extreme vigor of his devotion to this concrete method of learning was the natural consequence of his own peculiar type of intellect, in which the capacity for abstraction and causal reasoning and tracing chains of consequences from hypotheses was so much less developed than the genius for acquaintance with vast volumes of detail and for seizing upon analogies and relations of the more proximate and concrete kind. While on the Thayer expedition I remember that I often put questions to him about the facts of our new tropical habitat, but I doubt if he ever answered one of these questions of mine outright. He always said: "There, you see you have a definite problem; go and look and find the answer for yourself." His severity in this line was a living rebuke to all abstractionists and would-be biological philosophers. More than once have I heard him quote with deep feeling the lines from Faust:

"Grau, theurer Freund, ist alle Theorie,
Und grün des Lebens goldner Baum."

The only man he really loved and had use for was the man who could bring him facts. To see facts, not to argue or *raisonniren*, was what life meant for him; and I think he often positively loathed the ratiocinating type of mind. "Mr. Blank, you are *totally* uneducated!" I heard him once say to a student who proponded to him some glittering theoretic generality. And on a similar occasion he gave an admonition that must have sunk deep into the heart of him to whom it was addressed: "Mr. X., some people perhaps now consider you a bright young man; but when you are fifty years old, if they ever speak of you then, what they say will be this: 'That X.—oh, yes, I know him; he used to be a very bright young man!'" Happy is the conceited youth who at the proper moment receives such salutary cold water therapeutics as this from one who, in other respects, is a kind friend. We cannot all escape from being abstractionists. I myself, for instance, have never been able to escape; but the hours I spent with Agassiz so taught me the difference between all possible abstractionists and all livers in the light of the world's concrete fulness, that I have never been able to forget it. Both kinds of mind have their place in the infinite design, but there can be no question as to which kind lies the nearer to the divine type of thinking.

Agassiz's view of Nature was saturated with simple religious feeling, and for this deep but unconventional religiosity he found at Harvard the most sympathetic possible environment. In the fifty years that have sped since he arrived here our knowledge of Nature has penetrated into joints and recesses which his vision never pierced. The causal elements and not the totals are what we are now most passionately concerned to understand; and naked and poverty-stricken enough do the stripped-out elements and forces occasionally appear to us

to be. But the truth of things is after all their living fulness, and some day, from a more commanding point of view than was possible to any one in Agassiz's generation, our descendants, enriched with the spoils of all our analytic investigations, will get round again to that higher and simpler way of looking at Nature. Meanwhile, as we look back upon Agassiz, there floats up a breath as of life's morning, that makes the world seem young and fresh once more. May we all, and especially may those younger members of our association who never knew him, give a grateful thought to his memory as we wander through that Museum which he founded, and through this University, whose ideals he did so much to elevate and define.

WILLIAM JAMES.

HARVARD UNIVERSITY.

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*ON THE EFFECTS OF DISEASE AND SENILITY AS ILLUSTRATED IN THE BONES AND TEETH OF MAMMALS.**

I WAS very glad to respond to the invitation of your commitee to address you, for the reason that I have been for a long time interested in studying the effects of diseased action and senility, I hold that they are closely related and capable of being compared in precise ways with other morphological processes.

Am I right in assuming that to no other organization is it so appropriate to present the results of my investigation as to your own?

In a scientific sense the use of the words 'morbid' and 'pathological' cannot be sustained, for it assumes the existence of morbific principles. One might speak as reasonably of the use of the words 'dirt' or 'weeds' being warranted in treating of exact conceptions.

Disease tends to interfere with efficiency —in whole or in part—of the organism in which it is manifested. But this statement, you will observe, in no way relates to etiology. The difference between disease and senilty is apparent rather than real; for senility, like disease, is a condition tending to inefficiency. Many senile states resemble diseased states and include calcification, absorption, fatty degeneration, etc. But if these processes help the organism by preparing it for its work they cannot be called perversions, since all of them are present in early and confessedly normal states of the economy. Calcification is a normal process, whether we see it in the perpendicular plate of the ethmoid bone in the young adult or in the walls of blood vessels in the aged; absorption is a normal process, whether it is seen in the roots of the deciduous teeth in the young or in the orbito-temporal septum of the aged; fatty degeneration is a normal process, whether it takes place in the mature placenta and prepares the way to parturition or occurs in the form of an *arcus senilis*. But the results of these processes are enormously divergent, one maintaining physiological activities, the other hastening to decay and death.

Senility is of no definite period and, therefore, is without accurate limitation. The postulate that 'wear and tear' on tissues or organs which cannot be replaced occur in direct ratio to use is accepted. In low forms of life large portions of the economy, and some tissues even in the highest forms, are discarded and new ones take their place. Epithelial elements are constantly being thrown off, and in many animals teeth are lost when no longer of service and others are developed to supplant them. But in old age of high grade organisms we witness loss, rather than gain, both in organs, like the teeth and hair, and in tissues, as muscle fibres in the capillary blood vessels. So far as man is concerned, this period is, on the whole, included in the time when he is no

*A lecture delivered before the Graduate Club of the Biological Department of the University of Pennsylvania, December 7, 1896.

longer virile. I venture to call it the post-genetic period. The term senility, in addition to the usual ontogenetic sense, will be employed to express the changes that go on in a given group of animals on the decline from its acme of evolution, and attempts will be made to correlate these states with those occurring in the individual. (A. Hyatt.)

I propose to submit a number of facts which, for convenience, I have placed under the head of propositions, the number and variety of which give a clue to the intricacy of the subject.

It will be taken for granted throughout that the subject of variations of structure as usually limited has been carefully considered and set aside, for these do not invalidate any of the propositions.

I. *Reversion to lower types is sometimes witnessed in the senile human skull.*

Outside of Primates no mammal exhibits an orbitotemporal septum. In the senile human skull thinning, and often notable absorption of the septum is almost constantly exhibited.*

II. *Complex bones are sometimes analyzed in part by the manner in which absorptive processes occur in them.*

Many examples can be cited to illustrate the fact that bones originally separate tend to localize effects of diseased action even when the lines of separation between primal parts disappear. It is not expected that when the precoracoid bone of the cod is hyperostosed—a condition which has been often detected—that other portions of the suspensorium should participate. Neither do we find that when one-half of the lower jaw of a kangaroo is diseased that the other separate half should be involved. In the domestic cat the halves of the lower jaw are disposed to unite in old age, but even in this animal effects of inflammatory processes may be confined to one-half of the bone. In a specimen of an old cat in the Cornell collection the symphysis was united, the entire mentum thickened; but the right side of the jaw was without incisor teeth and was much larger and thicker than the left, which was provided with teeth.

The center for the premaxilla in the so-called superior maxilla of the human subject is sometimes absorbed after the suture lines between the bone and the maxilla proper have been obliterated.* In the malar bone of the human subject the lower half is sometimes separated from the upper by a suture. The bone when thus marked is said to be bipartite. The skull of a syphilitic subject in my possession exhibits absorption of the lower half of the left malar bone. Since the bipartite bone is exceedingly rare, it is probable that the specimen had not possessed the suture and that the absorptive process had stopped when the area corresponding to a distinct center of ossification had been covered. Even if the bone had been bipartite the circumscription of an absorptive process to an individual bone would have been none the less striking. In old age the peripheral venous openings on the bones tend to become enlarged. The arrangement of these openings sometimes defines the regions occupied by epiphyses which have long since disappeared. In the femur of the senile dog, for example, the line of separation of the distal epiphysis from the shaft is indicated by the venous foramina being enlarged on the periphery. I have never observed such disposition to manifest itself in vigorous adults.

III. *Bone processes are sometimes increased in size in senility, or appear in places where they are not seen in antecedent stages, though occurring normally in the species of related groups.*

In the aged human subject the styloid process is sometimes longer than in younger

* I described this in *Am. Journ. Med. Sci.*, 1870, 405.

* Ibid, p. 403.

adults. This is caused by ossification of the stylo-hyoid ligament, which is often represented by a separate bone in lower animals.

The domestic cat exhibits, as a rule, no tubercle on the lachrymal bone. In the senile skull of this species the tubercle is present. It is of interest to note that among the following skulls of *Felis* in the Academy of Natural Sciences, Philadelphia, and the National Museum, Washington, four only (*F. eyra* and *F. yaguarundi*, *F. catus* and *F. caracal*) exhibited the lachrymal bone as it is in the vigorous adult of *F. domesticus*. In the following species the tubercle was present, though small: *F. pardus*,* *F. rufus*, *F. canadensis*, *F. pardalis*,† *F. leo*. In the following it was large and formed precisely as in the old examples of the domestic cat, *F. caligata*, *F. onca*, *F. concolor*, *F. tigris*. Thus the form of the lachrymal bone in the old cat reverts to that of the prevalent type, not by absorption, as in Proposition I., but by the creation of a conspicuous process of bone.

The senile cat again exhibits hyperostosis of the lateral process of the frontal bone (post-orbital process) as well as of the ascending process of the malar bone. Thus these processes approach each other and indicate the tendency to union shown in related efficient forms of the clawed mammals in which such union actually takes place.

IV. *Both the upper and the lower jaws of certain mammals tend to elongate in old age.*

The animals already named possessing long jaws have the intervals between some of the premolars widened in senility. The vigorous greyhound has the third lower premolar almost in contact with the fourth, while in the jaw of an old mongrel it is widely separated therefrom. In a general way, it may be said that the last three premolars are all more widely separated from one another than in younger individuals. The cause appears to lie in the disposition for the jaw to extend forward somewhere in front of the region of the molar teeth; for the extraordinary wear that sometimes takes place between the lower canine and the upper outer incisor can be explained in no other way. In an old dog (No. 22,563, U. S. Nat. Mus.) the lower canine had pressed against the upper second and third incisors and had worn away the teeth. The permanent premolars always lie close together when recently erupted. This disposition appears to be a corollary to the law of the vertical succession of these teeth.

The large permanent teeth following the small deciduous teeth in exact infra-position compel the former to lie close together. But they tend to separate afterward, especially for the first and second to separate from the third and fourth. In the domestic cat the interval between the second and third teeth is more variable than between the others. As a rule, it is but 2 mm. in front of the third tooth, though it may be as much as 5 mm. These proportions are maintained throughout life in this species, so far as I know.

In the dog we have a much greater variety, since in the different breeds the face axis is modified. In the short-faced types the premolars retain their early crowded condition, or this may even be exaggerated; while in the long-faced types they tend to be separated, excepting the third and fourth teeth, which remain, at least in an example of the greyhound above noted, close together.

Putting aside the pug dogs and bull dogs, the variations in the intervals between the premolars are marked and appear to be independent of the relative length of the face to the brain case. In the St. Bernard the first lower premolar (counting it as a re-

*A small tubercle may occur in this species as a variation.

†Absence of tubercles may be noted as variations.

tained deciduous tooth) is nearer the canine than in any other variety. The interval between the third and fourth upper premolars is conspicuous in the rather short-faced Esquimaux dog and the St. Bernard.

Since in the domestic dog the increase in the length of the lower jaw occurs in phyllogeny (artificially in breeding) and in ontogeny the form is of exceptional value in the philosophic study of senility and diseased action. But the subject is correspondingly complex. So far as I know, no collections are available for its satisfactory study.

In old examples of *Glossophaga soricina* and *Pteropus poliocephalus* the intervals between the premolars is much greater than in younger individuals.

V. *Senile forms of one species may resemble in essential characters the typical forms of an allied species.*

The appearances forming the basis of this proposition may be found not only in aged animals, but in the vigorous stages of an allied species as well. Thus, an old example of *G. soricina* resembles the typical form of a closely allied species, *G. truei.**

VI. *Gross variations in the forms of teeth in closely related and highly specialized animals indicate that the types have become exhausted of their capacity to precise adaptation and are degenerating. The forms that degenerated teeth assume are those that simulate senile changes in animals less highly specialized than themselves.*

One of the most familiar changes incident to long use is the wear of the teeth. It would appear that the height of the tooth is in some degree proportional to the work that is expected of it; that the crown represents the accumulation of a definite amount of material to be used up in grinding. We have often occasion to note the effects, upon the jaws themselves, of the lowering of the height of the crowns of the teeth.

The fox bats, which are frugivorous, are composed of fifteen genera. With a single exception (*Pteralopex*), they retain molars whose cusps have almost disappeared. The fact can be otherwise expressed as follows: The departure from the habit of the consumption of animal food to that of fruit leads to rather abrupt changes in the tooth form, by which the cusps are rapidly worn away, one insular genus alone maintaining its ancestral cuspidation.

In the New World fruit-eating bats we have examples of similar abrupt changes, though carried out in a less uniform manner. The forms do not constitute in themselves a family, but are grouped irregularly within the family, most of the members of which retain carnivorous habits, and at best the lines between the carnivorous and the frugivorous types are not sharply defined. In the Vampyri out of thirteen genera the molars of one genus only (*Hemiderma*) have lost their cusps, while in the Glossophagina out of six genera the teeth of one doubtful member of the group (*Phyllonycteris*) have lost their cusps. But in the Stenodermina, of thirteen genera, all the cusps have been lost, or are retained in the shape of the merest rudiments of the carnivorous plan. In two remote genera (*Cephalotes* and *Ectophylla*), one in the Old World and the other in the New, the concave depressed molar crown has been so worn away as to bring the grinding surface of the enamel cap near the alveolus and apparently to create a new *system of cusps*, as if the tooth were a slate on which had been placed a problem which demanded that an older problem previously recorded on the same surface should be removed before the terms of the newer one could be stated. In the senile form of every bunodont mammal the molar teeth tend to have the crowns diminish by wear and all traces of cuspidation to be lost. To my mind there is no difference between the loss of all cusps in the last premolar and the molars of an old dog, and the way

* Proc. U. S. National Museum, 1896, 779.

in which cusps are lost in bats in passing from an insect-eating to a fruit-eating habit. The fruit-eating bats might be called senile forms, because they lost their cusps, just as reasonably as we may use similar language in describing an old dog. Both forms exhibit degeneration effects; in one it is phyllogenetic; in the other it is ontogenetic.

VII. *Entire loss of teeth in the human subject from old age will often be followed by hyperostosis which presents three kinds nearly answering in position to the three series of teeth, the incisors, the premolars and the molars.*

The same law which created the differentiation of the teeth continues to operate after the loss of teeth. This is modified by the characters of chronic rheumatism and syphillis. The best examples in illustration of the proposition are met with in the jaws of savages.*

VIII. *The manner of obliteration of sutures in the skull of mammals may be definitive.*

The parieto-squamosal and the sphenoido-squamosal sutures rarely disappear in the human skull, no matter how old the individual. The suture last named disappears in the dog in the early stages of senility. The two forms are thus distinguished as readily as by the employment of other characters. We do not hesitate to distinguish by rates of disappearance of cranial suture lines the Ophidia from other reptilian orders.

IX. *Muscles modify the shapes of long bones in proportion to the length of time they have been exercised.*

The power of the flexor muscles of the limbs, on the whole, is greater than that of the extensors. It is the flexors that hold the extensor tendons firmly against the long bones, even, indeed, if they do not create grooves for the accommodation of their tendons. The longer the time the extensors are thus held against the bones the deeper become the grooves. Hence the relatively deep grooves on the extensor surfaces of long bones, as in the patellar notch and the grooves on the distal end of the radius, tibia and fibula in old animals. In an old cat in the collection of Professor Wilder at Cornell University the groove for the *Tibialis posticus* was converted into a bony canal.

Proposition IX. is also illustrated in the groove for the *Extensor longus pollicis* of the common brown bat (*Adelonycteris fusca*) becoming deeper in old individuals. At times the sides of the groove become enormously thickened by hyperostosis.

X. *In ontogeny a senile form of an annually recurrent structure may resemble the juvenile form and recall in phyllogeny the primitive form.*

The horn in an old specimen of *Cervus canadensis* tends to reassume the form of the spiked horn of young specimens, which at the same time recall the shape of the primitive horn in Pecora generally.

XI. *Inflammation of bone modifies the shape in places which exhibit the greatest physiological activities, and these prepare the way to senile changes in the same regions.**

The deepening of extensor muscle grooves when carried far will, we assume, develop friction and with the friction excess of heat and with the heat inflammation and resulted hyperostosis. But excess of heat may arise from undue exaltation of functions of any kind. In the following instances it has been productive of grave results from the conjunction of restrained growth force in the halves of the lower jaw and the eruption of the incisor teeth.

In the lower jaw of the domestic cat whose permanent premolars are just being erupted the symphysal articular surfaces are nearly smooth; in that of an animal

* Proc. Acad. Nat. Sci., 1893, 11.

* In studying the jaws of the domestic cat I have been struck by the frequency of effects of traumatism, especially of fractures of the teeth. It will be assumed that in the above statement all instances of disease following injuries have been excluded.

whose premolars are erupted the surfaces are uneven by the processes interlocking to fix the symphysis securely. At the same time that this change is announced the incisors are coming in place. The second tooth lies at first back of the first and third, so the alveolar region is twice as broad as when a little later all three teeth are in line. Thus great activities of the symphysal and alveolar regions are coincident. It is at this stage that the cat is prone to disease at the mentum. In forty-eight examples of adult lower jaws examined from your cabinet, thirty-three showed hyperostosis of the alveolar region for the incisors, the antero-posterior diameter being 5 mm. (a measurement twice that which is normal), with loss of at least one incisor, at a time when the sectorials were but slightly worn, while the jaw in other respects showed fully adult characters. In studying senility we are prepared to find the mentum exhibiting frequent changes from the normal. The entire region is often hyperostosed or carious; the incisors in part or entirely lost, and even the canines loosened or lifted by filling up of the bottoms of their sockets. In this manner a slightly plus physiological activity in the young has prepared the way to variation in adult life and to characteristic changes in old age. In the collection I found seven examples of these changes in very old bones. I am informed by Dr. Burk that, since the greater number of cats used for dissection are not over two years old, the number of senile examples in the collection is probably much less than would be found to be the case if data could be collated from life histories of the species secured under average circumstances.

It is impossible to say which of the characters outlined in the above propositions (save alone Prop. VI.) can be transmitted. It is safe to assert that many of them are sporadic in character, though I do not believe them to be adventitious.

As the individual nears the time of its own extinction it experiences changes in the composition of its tissues and gross variation in characters. Groups of animals which are also approaching extinction behave in a similar manner. Ontogenetic comparison in the first case should be made with the phyllogenetic comparison in the second as well as with the more efficient of their own types. The aged individuals of the domesticated Bovidæ, for example, should be compared with all the younger adult individuals of the Aurochs.*

The senile horse should, in like manner, be studied with the phyllogeny of the group to which it belongs. Since our knowledge of this is relatively precise, I have long thought the comparison would be of exceptional interest.

The difficulty in procuring material for studies in senility is very great and probably accounts for the slight attention which has been given the subject. I wish in this connection to gratefully acknowledge receipt of specimens from Professor Burt G. Wilder, Cornell University, from Dr. Charles Burk, University of Pennsylvania, and from Messrs. F. W. True and F. A. Lucas, of the U. S. National Museum. I respectfully solicit additional material from those who do not object to having their cats, dogs and other animals used for scientific study after they have ended honorable careers as household pets.

Harrison Allen.

Philadelphia, Pa.

*G. S. Miller, Jr. (Science, November 20, 1896, 744), in abridging Büchner's account of the degenerate and lingering European bison herd, speaks of the prevalence of abnormal conditions in parts of the skeleton. According to the tenets of the above essay, these conditions will yield, when studied, the best results when compared with those found in other vigorous groups of genera of the Bovidæ, as also with effects of age and disease in the life history of an individual of any one of the species.

AMERICAN METROLOGICAL SOCIETY.

AT the call of the Council the Society held its annual meeting at Columbia University on Monday, December 21, 1896, Professor Egleston presiding. The Society was officially informed by the Secretary, J. K. Rees, of the deaths of their President, Dr. B. A. Gould, of Cambridge, Mass., and of their Councillor, Professor H. A. Newton of New Haven.

The following minutes were adopted and ordered printed in the daily papers:

The American Metrological Society has heard with profound sorrow of the death of their honored President on November 26th. Dr. Gould was President of the Society from 1889 to the time of his death, succeeding the late President, F. A. P. Barnard. By his ability, learning and enthusiasm he did much to further the objects of the Society, and as a member of the National Academy of Sciences and of the International Bureau of Weights and Measures his influence in metrology was world-wide.

Of late years he was especially interested in throwing the whole strength of the Society in favor of the early adoption of the metric system. It was his earnest wish and hope that before he passed away he would see the metric system adopted by the government and the people of this country.

Professor Hubert Anson Newton, of Yale College, was a member of the American Metrological Society from its organization to the day of his death, August 12th, and was for many years a Councillor. His interest in the work of the Society was great and continuous. He was especially active and conspicuous in the agitation of thirty years ago, which resulted in the enactment of the law of 1866 legalizing the use of the metric system. He prepared the table of metric equivalents, of customary weights and measures, which was incorporated in this act, and by which the relation of fundamental units was defined. Professor Newton's high rank as a man of science, his excellent judgment, and his clear, practical insight in matters relating to administration, made him an especially valuable member of the Society.

The Treasurer reported receipts for the year 1896	$460.50
Balance from 1895	686.54
Total	$1,147.04
Expenditures for 1896	705.89
Balance on hand	$441.15

The Secretary reported on the work of the year 1896. This report showed that some 50,000 documents relating to the metric system had been sent throughout the United States.

The latest paper issued by the Society was Dr. T. C. Mendenhall's reply to Herbert Spencer. This reply was printed in the *Popular Science Monthly* for October, 1896. The Society obtained 10,000 reprints. 5,000 copies of this reprint had been ordered by the New Decimal Association of London.

Professor Rees presented his resignation as Secretary and Treasurer. He stated that he could no longer spare the time for the onerous duties connected with the two offices.

The following officers were then elected: President, T. C. Mendenhall, of Worcester, Mass. Vice-Presidents, Wolcott Gibbs, of Newport, R. I.; T. R. Pynchon, Hartford, Conn.; A. A. Michelsoff, Chicago, Ill.; T. Egleston, New York City; H. A. Rowland, Baltimore, Md.; J. H. Van Amringe, New York City; J. K. Rees, New York City. Treasurer and Recording Secretary, W. Le Conte Stevens, Troy, N. Y. Corresponding Secretary, O. H. Tittmann, Washington, D. C. Members of the Council, Cleveland Abbe, Washington, D. C.; R. H. Thurston, Ithaca, N. Y.; A. M. Mayer, Hoboken, N. J.; Henry Holt, New York City; Simon Newcomb, Washington, D. C.; W. F. Allen, New York City; S. P. Langley, Washington, D. C.; George Eastburn, Philadelphia, Pa.; C. A. Schott, Washington, D. C.; H. Jacoby, New York City.

On motion of Professor Van Amringe the following minute was recorded: "In yielding to the earnest request of Professor J. K. Rees to be allowed to retire from the offices of Treasurer and Recording Secretary, the Society expresses its sincere regret and its high appreciation of his laborious and effective services for fifteen years in conducting its business and in furthering the purposes for which it is organized."

Dr. Mendenhall remarked:

"Mr. Chairman: In seconding the resolution offered by Professor Van Amringe, I beg to offer very briefly my own testimony as to the great efficiency of our Secretary, who now insists upon retiring from that important office. It will be remembered that a year ago Professor Rees urged upon the Society the acceptance of his resignation, but finally yielded to the urgent desire of our lamented President, Dr. Gould, and to that of every member of the Society, that he might continue at least for another year, as it was believed that the affairs of metrological reform in this country were in rather a critical condition and no one so well as he could direct the affairs of the Society during that period. His energy and industry in the administration of the laborious duties of his office are well known to us all. The Metrological Society, although not large in numbers, is great in its performances, and we all recognize the fact that in a large measure the success of these performances is due to the Secretary. If I may be permitted to refer to this action of Professor Rees in connection with the fact that I have been by your partiality elected to the Presidency of the Society, I desire to express my personal regret that in the performance of my duties during the coming year I shall be deprived of the advice and cooperation of Professor Rees in an official capacity.

"I may be permitted to remark at this point that I fully appreciate the high honor which has been conferred upon me by your choosing me to succeed the two distinguished men who have before been Presidents of this Society, and, while fully appreciating my own inability to discharge the duties which will come to me as I would like, I at the same time wish to express the sense of loss which I feel in the resignation of Professor Rees, upon whom the most inexperienced might lean with confidence. It is a consolation for us to know, however, that we shall not in any degree lose the interest and activity of our late Secretary in his separating himself from the onerous duties of the office."

The Secretary reported that, at the Annual Convention of the Colleges and Preparatory Schools of the Middle States and Maryland, at Philadelphia, November 28, 1896, a resolution favoring the adoption of the Metric System was introduced by S. A. Farrand and was adopted with one dissenting vote. This association comprises about fifty colleges and universities and also eighty preparatory schools.

The Secretary reported that the Committee on Weights and Measures of the Boston Society of Civil Engineers had obtained the opinions of a majority of its members on the proposed action of Congress with relation to the use of the Metric System.

Postal cards reading as follows were sent to each member:

"I am———in favor of the passage by the present Congress of an Act requiring the metric weights and measures to be in use by the government departments generally by the beginning of the Twentieth Century, January 1, 1901."

"I should———be willing to have people generally of their own accord adopt metric weights and measures for their ordinary business transactions, and especially for those in which I am myself concerned, at the same time at which the government departments as a whole actually do adopt them."

The total number of cards sent out was	404
The total number of cards returned was	229
Number in favor of both clauses of the card	193
Number against both clauses of the card	21
Number for first clause and against second	2
Number against first clause and for second	11
Members in favor of a decimal system	2

The following interesting letter was read:

Picton House, Thames Ditton,
Surrey, England, December 11, 1896.

J. K. Rees, Secretary—*Dear Sir:* We beg to acknowledge your letter of the 28th ult., and are procuring a copy of the Blue Book containing the Report of the Select Committee of the House of Commons on Weights and Measures, before which evidence was given by one of our Directors, Captain H. R. Sankey,

R. E. We will send this to you as soon as possible, with the portion relating to our experience marked. Meanwhile, in case it does not reach you to be in time for use, we will state here that our reasons for adopting the *metric linear measures* were mainly two, both commercial: (1) To enable us to continue the interchangeable system, on which we work with our Continental licenses, and (2) to promote the sale of our engines in countries using the metric system.

It was considered possible that, although a specialty, the fact of our engines being figured in inches might tell against them when competing with others figured in millimetres. The results have been most satisfactory in all departments. In the drawing office it has been found that the change makes it easier to design, calculate, plot dimensions, check and read drawings. No mistakes have been made that can be traced to the change. In the works, where we chiefly work to gauges, there has been no difficulty in marking the latter, and marking off is easier. In a short time the men preferred metric measurements, and the change has involved no difficulty whatever. Trusting this may be of service to you, we are, sir,

Yours faithfully,

(Signed) WILLANS & ROBINSON.

THERE were also presented the following extracts from British Consular Reports collected by the New Decimal Association established to Promote the Adoption of a Decimal System of Weights, Measures and Coinage in the United Kingdom:

ROTTERDAM, October 22, 1894.—"The simplicity of the Decimal System is so obvious that its adoption in England cannot fail to be of great advantage to all interested in the trade with those counties where it already is in vogue."

MILAN, ITALY, October 18, 1894.—"As an engineer of some 20 years' residence upon the Continent, I have no hesitation whatever in stating that the present system of English weights and measures is detrimental to British commercial interests in countries like this, where the Decimal and Metrical System is in force.

"The sooner the Decimal System is adopted by Great Britain the more advantageous for her commercial interests when trading with the Continent in particular, as also to facilitate home calculations, especially in engineering departments, where excessive accuracy is an absolute necessity."

VARNA, October 23, 1894.—"If the quotations and specifications in Trade Lists are made out in English Standards of Weights and Measures, intending purchasers here generally throw them aside and consult others which give the required information in metres, kilogrammes, etc.

"In the Varna Trade Report for 1892 it is mentioned that it is especially in hardware and machinery that the non-adoption of the Metrical System acts most prejudicially against British manufactured goods.

"Commission agents here have repeatedly told me that though they represent British firms also they have, when a customer requires *precise* data as to the working and capabilities of a machine, to refer to some rival foreign maker's catalogue, with the result that the order is often placed with the latter.

"Not long ago a man came to me with the price list of a British machinery maker, and I converted for him the specifications into their metrical equivalents. He then said that the machine in question seemed just what he wanted, and that he would order one for trial, and give repeat orders if it turned out satisfactory. Meeting him again some time after, he told me that, although he would have preferred buying the English machine, he had imported one of German make, firstly, because he could not be bothered with recurring calculations based on an unfamiliar system, and secondly, because the measurements did not properly coincide with his existing machinery plant of Continental make."

CONSTANTINOPLE, October 22, 1894.—"There is no doubt that the complicated and puzzling system of weights and measures still obtaining in England is long out of date, and has become more and more of an anachronism as England has increased her foreign trade.

"Personally I have, during my long official career, seen so frequently the inconvenience of the old system that I have for very many years been a convert to the ideas of your Association."

ROUEN, October 24, 1894.—"Within the past 16 years I have served as H. M.'s Consul in three countries using the Metric and Decimal Systems, and I have not unfrequently had occasion to observe the maze into which an English trade prospectus or circular, if drawn up only on the British system, throws a foreigner accustomed from childhood to the perfect simplicity of the Metric System. And there is no doubt in my mind that the uncertainty and confusion thus created at times leads to the rejection by a would-be purchaser of a British manufacturer's circular or offers of sale.

"The British customs tariff is a model of brief simplicity, and yet we are often called upon to explain it. Within the past month I have been asked to explain 'what a duty of 14/6 a gallon means and what is 7/- a cwt. for dried fruit?' That is to say, what are their equivalents in metric weights and

measures and decimal currency? Foreign exporters to the United Kingdon would be thankful for a simple table of the British customs tariff in which the equivalent duties and units of Continental Metric Systems were shown in parallel columns beside our own."

FLUSHING, October 20, 1894.—"The adoption of the Metric System of Weights and Measures in Great Britain and her dependencies would, to my conviction, greatly benefit English manufacturers and tradesmen, and would certainly contribute to facilitate and extend business with this country."

MARSEILLES, October 23, 1894.—"Very often French merchants have complained of the great difficulty they had in reducing English weights or measures into those of the Metric System, and I have not the slightest doubt that if the said system was adopted in England it would greatly facilitate trade with this country."

LISBON, October 24, 1894.—"I am of opinion that our industries are materially handicapped in the competition with foreign manufacturers by the isolation of our system of weights and measures.

"The small tradesmen are, therefore, the real representatives of trade abroad, or at all events are fast becoming so. We should, therefore, cater to their requirements and cultivate their custom, for their friendship, to the full extent of the word, is of 'value' to us.

"In this regard I think I may safely say that to the tradesmen of foreign countries our system of weights and measures is a constant stumbling-block and acts as a deterrent. Not one in a thousand understands it, and rather than suffer the perplexity of it, or risk the loss that an erroneous computation would entail, pass on to our neighbors, who speak and write to him, in his native language, of Metres and Kilos. He thereby knows what he buys, knows what he has to clear through the custom house without risk of fine or forfeiture, and knows the length and cube which leaves him a profit when he sells.

"For these reasons I doubt not but that we lose in the aggregate much valuable trade."

ALGIERS, October 24, 1894.—"I have no doubt whatever that our antiquated and most irrational system has had an injurious effect wherever it has been employed."

VIENNA, October 26, 1894.—"I believe the adoption of the Metric System of Weights and Measures in Great Britain and her dependencies would highly benefit English importers and exporters."

MALAGA, October 23, 1894.—"I have heard purchasers here say that they bought German goods in preference to English ones because German merchants sent out their price lists made out with the prices in Spanish currency and weights according to the Metric System, whereas the British merchant always sent his made out according to English weights and currency.

"I consider that British trade with Spain would increase if we adopted the Metric System."

CHERBOURG, October 27, 1894.—"I am convinced that if a metrical system of measurement and a decimal system of coinage were established in England it would materially benefit British trade, especially with those countries, such as France, where those systems are adopted."

BORDEAUX, October 20, 1896.—"If the views of the New Decimal Association were adopted by the legislative authorities they would, I believe, greatly contribute towards facilitating, and consequently towards extending, British commercial relations with foreign countries."

MADRID, October 25, 1896.—"You have my sincerest sympathy in your endeavors to make the Metric System compulsory in England. The numerous advantages of such a system are obvious and, moreover, its adoption would greatly facilitate the commercial relations of Great Britain with the rest of Europe."

BERN, October 21, 1896.—"In transacting my official business I have frequently observed that the present English system of weights and measures is certainly detrimental to British trade in my consular district. I should, therefore, strongly urge and advocate the compulsory adoption of the metric weights and measures in Great Britain and Ireland."

ROSTOCK, October 20, 1896.—"I can only say that if such a measure as the metric weights and measures bill' be adopted compulsorily it would be greatly beneficial to all who have to do business with Great Britain and also to all British subjects who have to do business with the Continent."

KIEL, November 12, 1896.—"The inconvenience which was felt when the change was made in this country was soon overcome and the reform met with universal appreciation."

BREST, October 19, 1896.—"The advantages of the Metric System are recognized by all, and were it adopted in England the British tradesmen would greatly benefit by it in his transactions with France, as at present a Frenchman will not take the trouble to calculate the value of English weights and measures into French equivalments; hence no business is done."

SEVILLE, October 30, 1896.—"I heartily sympathise with the objects of your association, and in many commercial reports have drawn attention to the loss of British trade through tendering in British weights and measures and in sterling."

TENERIFFE, September 10, 1896.—"The customer, instead of seeking British firms to whom to give his

orders, now has the goods of other countries brought daily and cleverly to his immediate notice, by adroit commercial travelers or by extensive catalogues, in the language which he understands, which give him every particular of the article he wants *in the weights and measures and currency of his own country*. What English firms carry a commercial enterprise to this extent? Some doubtless do; the majority do not. But these things must now be done, and many others, unless we are willing to give up without a struggle our well earned commercial and industrial supremacy."

SOFIA, October 14, 1896.—"I have several times referred, in previous reports, to the difficulties which arise to hindrance of commerce in consequence of the obstinacy of Great Britain in adhering to its antiquated system of weights and measures and money."

VERA CRUZ, December 3, 1896.—"The compulsory use of metric weights and measures with regard to British goods exported to foreign countries and their use in quotations and advertisements of such goods, in lieu of Imperial weights and measures, would greatly tend to the benefit of the British export trade."

AMOY, November 17, 1896.—"For many years I have been convinced that the introduction of the Decimal System into our weights, measures and money would effect an immense saving of labor and would vastly increase the wealth of our country, and that it would greatly facilitate the sale of our commodities to foreign countries. I am very much rejoiced that an association has been formed to educate public opinion at home as to the advantages of the Decimal System and to bring the matter to the cognizance of the government."

FOREIGN OFFICE, LONDON, November 17, 1896.—"I am directed by the Marquis of Salisbury to inform you that a dispatch has been received from Her Majesty's Agent and Consul-General at Cairo. Lord Cromer considers that a very general opinion undoubtedly exists in Egypt that British trade with that country would benefit by the adoption of the Metric System of Weights and Measures."

It was voted that the next meeting of the Society be held at such time as the Council shall direct.

THE APPRENTICESHIP QUESTION.

THE *American Machinist* has been doing a work of great interest and importance to the sociologist and the political economist, in the collection of facts relating to the apprenticeship question. Its editors have sent out to a large number of employers and managers of manufacturing establishments, and also to representative men among the trades-unions, a circular letter, calling for their experience and opinions relative to the desirability of maintaining the old methods of apprenticeship, and of thus insuring a supply of skilled labor in the coming generation. The summary of this, which is probably the first, attempt to secure reliable information at first hand, in this manner, is published in the issue of December 24th, which is substantially all devoted to the subject. It makes a mass of material which will well repay study and serious consideration.

A discussion in which this matter was made prominent took place at the Detroit Meeting of the American Society of Mechanical Engineers, which showed that the great leaders in the manufacturing industries of the country were very much alive to the importance of this question, and some interesting facts and opinions were there given, for which the transactions of that Society may be consulted. Articles appearing in the *Century Magazine* in 1893 also bear directly upon the subject. In the latter discussion, however, it is assumed that apprenticeship is abandoned, and that trade schools only can be expected to replace the older system in the supply of skilled labor. This assumption is proved to be without as much foundation as had probably been generally supposed. Of the 116 establishments contributing to this later discussion, 85 take apprentices—73 per cent. of the whole number—and 92 per cent. of these express themselves as satisfied that the system is a good one, even for our time. Forty-seven per cent. of all those taking apprentices have written agreements and contracts with them. The general trend of testimony seems to be in favor of taking a boy for a probationary period, to ascertain his capabilities and disposition, and

then, if approved, binding him by contract for a definite time, retaining a part of his wages in the earlier period to insure his remaining the full time agreed upon; one of the difficulties met with being the fact that the average boy has little idea of the binding force of a contract.

The trades-unions apparently exert no important influence either for or against the system. Where they do seek to control at all, it is by restricting the number of apprentices to that proportion which, in their opinion, will give a sufficient number without flooding the trade with unemployed young men or displacing older workmen by their youthful rivals. According to the editors of *The American Machinist*, no foundation has been by them discovered for the sweeping conclusions of the *Century* articles. In so far as the system, once universal, of taking apprenticeship has been given up, the fact is probably due, not to adverse action of trades-unions, but to the fact that modern methods of manufacturing, in many cases, do not well lend themselves to this older way of providing workmen. But "nothing like a complete or general abandonment of apprenticeship has taken place in machine shops, and apprentices can be, and are, taught the trades of machinist, molder, pattern-maker, etc., with entire success and with satisfaction to all concerned, even in shops where modern methods of working and management have been most highly developed."

One of the most important deductions from all this valuable testimony is that it is essential to success that, first of all, boys should be admitted to the privileges of apprenticeship *only* when good natural mechanics, when evidently intended by nature for the work, and when earnest and ambitious, honest and frank and reliable.

These communications and the editor's comments will well repay deliberate study.

R. H. Thurston.

HENRY L. WHITING.

Mr. Henry L. Whiting, Assistant U. S. Coast and Geodetic Survey and Chairman of the Massachusetts Topographical Survey Commission, died at his residence in West Tisbury, Martha's Vineyard, on Thursday, February 4th, the last day of the seventy-sixth year of his life. Mr. Whiting's position as a public officer was in many ways unique; his services in the corps to which he belonged were noteworthy, and he had, in addition, filled many positions of responsibility and dignity, which came to him in recognition of his high character and professional accomplishments. A brief account of a career so remarkable will be of interest to the many who knew him, either personally or through his work, and to all who appreciate a life full of useful activities in faithful and efficient public service.

In the length of that service it is doubtful if his equal is now living. Had Mr. Whiting lived a few weeks longer he would have entered his sixtieth year of continued public service, all as an officer of the Coast and Geodetic Survey, which he entered at an early age. He served some time under Hassler, the first Superintendent, and for many years he stood alone as the only member of the corps who had served under *every* Superintendent of the Survey.

Mr. Whiting was born at Albany, New York. His father was a Judge of the Court of Common Pleas at Troy. His grandfather was William Bradford Whiting, a colonel in the Revolutionary War and a lineal descendant of Governor William Bradford, of the Plymouth Colony. One of his brothers was a classmate of General Grant at West Point and held high rank in the army at the time of his death; another was graduated at the Naval Academy, was one of Commodore Perry's officer's in the Japan Expedition, himself holding the rank of Commodore at the time of his death. Others of the family were distinguished, but Henry

Lawrence, the youngest, survived them all, except a sister, now residing in Philadelphia.

In the Coast Survey his great work was the development of the topographical operations of that bureau. He was regarded as the father of the system so long and so successfully in use, and every topographer in the service has at some time been under his direction and instruction. He did, indeed, direct at one time the main triangulation of the coast of Florida, but his tastes and instincts were so strong in the direction of topography that he was at an early day given entire charge of that department of the Survey. Besides being actively engaged in field work, he continued throughout most of his life to serve as general topographical inspector.

Of the general conference of the topographers of the Survey held in Washington in 1892 he was chairman, and, although then over seventy years of age, one of its most active and useful members. By detail of the Superintendent, Professor Peirce, Mr. Whiting inaugurated the instruction in land and harbor surveys at Annapolis, and under a similar detail he served for two years as professor of topographical engineering at the Massachusetts Institute of Technology. He was consulting engineer for the Massachusetts Harbor Commission for twelve years and a member of the Commission for three years. He was actively related to and a member of other harbor surveys and commissions at various points along the New England coast. With the approval of the Superintendent he was appointed, in 1884, a member of the Massachusetts State Topographical Survey Commission, serving as chairman after the resignation of General Francis A. Walker, in 1892. In 1890 he was appointed a member of the Mississippi River Commission by President Harrison, whose grandfather's inaugural address he had heard from the east front of the Capitol while temporarily at the office of the Coast Survey after a long period of field duty. He continued to serve on this Commission until his death.

In common with a number of his colleagues in the Survey, Mr. Whiting did important service during the Civil War. Of those officers absent in the field at the time of its beginning he was the first to report in Washington for volunteer service, reaching there by way of Annapolis, after Baltimore was cut off, at the same time with the New York 7th Regiment. During the war he made many topographical surveys for military purposes. On the laying of the French cable it was on his recommendation, the question having been referred to him, that Danbury was selected as the terminal station, his excellent judgment being fully proved by the remark subsequently made by Sir Charles Hartley that it was the most successful ocean cable landing in his experience.

Personally Mr. Whiting was most agreeable and charming. He had the dignity of manners which is usually associated with 'a gentleman of the old school,' along with a simplicity of character and openness of heart that made him beloved by all who came in contact with him. He was a man of splendid physique, as his long and uninterrupted service shows, and even after passing the allotted threescore and ten he never shrank from any duty, however arduous it might be. His activity in the field ceased only with his death, and in 1894 he was, by direction of the Superintendent, in general charge of the resurveys of Boston Harbor, the field work of which was done by a half dozen of his younger colleagues.

During some months before his death the unusually excellent condition of his health and his ever youthful spirit excited comment among his friends; the end of his life had not for several years seemed more remote than on the day and within the hour

in which it came. In his nearly sixty years of continuous public service he achieved a distinction in his profession of which his corps may well be proud, and all who have enjoyed personal relations with him will hold him in loving remembrance. M.

ZOOLOGICAL NOTES.

THE GENERIC NAMES ICTIS, ARCTOGALE AND ARCTOGALIDIA.

In my Synopsis of the Weasels of North America, published in *North American Fauna*, No. 11, June, 1896, I adopted the subgenus *Ictis* of Kaup, 1829, for the ordinary weasels. This name, however, is untenable for the weasels, being antedated by *Ictis* Schinz, 1824. Schinz, in his 'Naturgeschichte und Abbildungen der Saugethiere,' published at Zurich in 1824 (p. 110), gave the name *Ictis* to the Binturong (*Ictis albifrons*), which of course renders it subsequent use for a different group impossible.

The subgenus of weasels to which I applied the name *Ictis* Kaup takes the name *Arctogale* Kaup, 1829, with *Putorius erminea* as the type species. This use of *Arctogale* by Kaup, as stated in my Synopsis of the Weasels already referred to (p. 9), precludes its subsequent use by Peters and Gray (1864), and later authors for the Palm Civets, a genus of the family *Viverridæ*, for which latter genus I propose the new name *Arctogalidia*, the type species as before being *A. trivirgata*.

C. Hart Merriam.

CURRENT NOTES ON ANTHROPOLOGY.

WOMAN IN SOCIOLOGY.

The *Revue de Sociologie* for 1896 (No. 7) has a detailed report of the 'Congrès féministe' held at Paris last summer, well worth reading by those interested in the sociological aspect of the 'woman question,' as presented by women themselves.

The crucial question of marriage was discussed amply, the general tendency being to discard it altogether in favor of free unions, which, it was argued, would generally be monogamic and lasting, in a ripened society.

The closely related question of prostitution was actively debated. Its legal regulation was condemned for many reasons, especially that men have no right to legislate as to what a woman shall do in that respect. The prevailing view was "that a woman should be absolutely free to sell herself or not, as she may choose," to quote the words of one of the (female) speakers.

Co-education proved a stumbling block, strange as that may seem to us. It was considered dangerous and likely to develop mannish women. All agreed that full civil and political rights should be given to women.

ANCIENT MAN IN ENGLAND.

The President of the Anthropological Institute of Great Britain, Mr. E. W. Brabrook, published an article in *The Archæological Journal* for September last, touching upon the antiquity of the remains of man in Kent. It will be remembered that the stone relics from the chalk plateau of that region were closely studied by the late Sir Joseph Prestwich and others. They are very rude and geologically apparently very ancient, some claiming that they must be pre-glacial. Mr. Brabrook is of opinion that whenever it was that man first discovered the art of chipping stone, it certainly originated in Kent, 'and by all that we can judge from, as early in Kent as anywhere.'

This assertion is none too bold. It does not mean that from Kent this simple art spread over the world, but that in that locality we can trace a real beginning of human culture. Whether it can be followed in an uninterrupted development down to historic times, he considers more doubtful.

THE CHACO IDIOMS.

STUDENTS of American languages are laid under further obligations to Mr. Samuel A. Lafone Quevedo by his recent publications on the Mbaya dialect, and those of the Matacos and Mataguayos. They are published in the Boletin del Instituto Geografico Argentino, Tom. XVII. The last mentioned is drawn from the vocabularies of the traveler d'Orbigny, and is prefaced with a valuable introduction. The Mbayas are the Guaycurus of the older writers.

The tribes of the Gran Chaco have remained in the utmost entanglement and doubt until the numerous and careful studies of Lafone Quevedo have enabled us to classify them with a close approach to correctness. Here, as elsewhere, when it becomes possible to compare in detail a number of tongues, we find that many of their dissimilarities disappear, and the supposed diverse stocks melt into related groups of dialects.

D. G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

ASTRONOMICAL NOTES.

WE learn from the February number of *Popular Astronomy* that Dr. See and Mr. Cogshall have discovered a number of new southern double stars at the Lowell observatory in the city of Mexico. Five objects are enumerated. Strange to say, three of these objects are bright stars with very faint companions of about the 13th magnitude, all situated at pretty nearly the same distance and position angle with respect to the principal star. The *a priori* probability of such a triple discovery is so small that we suspect the possibility of the observer's having been misled by a 'ghost.' We shall look with interest for a confirmation of these discoveries, if there is any other large telescope far enough south to examine these objects with any hope of success. Possibly the new McLean telescope, soon to be mounted at the Cape of Good Hope, will be able to show these double stars.

THE *Astronomische Nachrichten* of January 15th contains an article by Dr. F. Cohn, in which he gives a new explanation of the systematic errors of heliometer measures. It has been found by various astronomers that measures of small distances made with this instrument require positive corrections. Dr. Cohn now points out that these peculiarities can be explained if we assume that all distances, both large and small, require the same systematic correction. This idea leads to the simplest explanation of these puzzling systematic errors that we have yet seen.

IN the January 26th issue of the same journal Dr. Wilsing considers the question of the absorption of light in astronomical objectives, and shows that, if the size of objectives be continually increased, a point is soon reached where the absorption more than counterbalances the increase in the light-gathering power. If the size of the objective be increased beyond this point the quantity of light reaching the focal plane will diminish.

WE have received a Doctor's dissertation by W. Ebert, in which the author deals with the possible disruption of the Solar System by the passage through it of a star having very great velocity. He comes to the conclusion that such an event would probably not produce disturbances of any great importance, unless one of the planets should happen to lie very near the course of the passing star.

H. J.

SCIENTIFIC NOTES AND NEWS.

M. A. CHATIN has been elected President of the Paris Academy of Sciences in succession to M. A. Cornu. M. M. Cornu has been elected President of the Botanical Society of France.

M. FAYE, the eminent astronomer and meteorologist, who is now eighty-three years

of age, was elected a member of the Paris Academy of Sciences fifty years ago. This jubilee was celebrated by the Academy on January 24th, a speech being made by the President and a gold medal being presented to M. Faye. In the evening a dinner was given to M. Faye, at which he was presented with the insignia of the Grand Cross of the Legion of Honor.

The Matteucci Medal of the Italian Society of Sciences has been awarded to Professor Rowland, in recognition of his work in spectrometry.

The London Society of Engineers has awarded the following premiums for papers read during the year: The President's gold medal to Mr. George Thudichum for his paper on 'The Ultimate Purification of Sewage;' the 'Bessemer Premium' to Mr. D. B. Butler for his paper on 'The Effect of Admixtures of Kentish Ragstone, etc., upon Portland Cement;' the 'Rawlinson Premium' to Mr. W. G. Wales for his paper on 'Discharging and Storing Grain,' and a 'Society's Premium' to Mr. M. A. Pollard-Urquhart for his paper on 'Examples of Railway Bridges for Branch Lines.'

The lectures at the Johns Hopkins University by Sir Archibald Geikie on the principles of geology, which we have already announced, will be given daily, beginning Wednesday, April 21st. In addition to the six lectures which compose this course, strictly intended for geologists, Sir Archibald Geikie will give one public lecture during his stay in Baltimore.

Dr. Alexander C. Abbott, professor of hygiene in the University of Pennsylvania, has been appointed chief of the bacteriological division of the Philadelphia bureau of health.

M. Filhol has been elected a member of the section of anatomy and zoology of the Paris Academy, in the room of the late M. Sappey.

Mr. Middleton Wake, the Sandars reader in bibliography at Cambridge, will deliver four lectures on 'The Invention of Printing,' with special reference to book illustration.

The Berlin Academy of Sciences has made a grant of 600 marks to Professor H. E. Ziegler, of Freiburg, for his studies in the mechanics of development.

According to the *British Medical Journal* the subscriptions in France and other countries for a statue to Pasteur now amount to more than £10,000. M. Paul Dubois has been selected as the sculptor, and the site for the statue will probably be the space between the Rue de Médicis and the Luxembourg Gardens. More than £20,000 has already been spent in the erection of statues of Pasteur in various parts of France.

The city of Mexico has given the name of Pasteur to the gardens situated in front of the National School of Medicine in that city.

The following resolutions were adopted by the staff of the United States National Museum, February 6th:

"Whereas, Major Charles E. Bendire, of the United States Army, Honorary Curator of the Department of Oology in the United States National Museum, has been removed by death,

"*Resolved:* That in Major Bendire's death the National Museum suffers the loss of an officer who took the keenest interest in his special branch of work; whose constant aim was to improve and develop the department under his charge; and to whose unfailing interest the present admirable condition of the oological collection is due.

"*Resolved:* That in his death the National Museum has lost a valued member of its scientific staff whose place it will be difficult to fill, and American ornithology has been robbed of one of its most earnest workers."

Professor Galileo Ferraris died at Rome on February 7th, aged fifty years. He was principal and professor of applied physics of the Museo Industriale of Turin and a member of the Italian Senate. He made important contributions to electrical science, especially to the phenomena of alternating currents.

We regret to record the deaths of Professor Sätherberg, of Stockholm, the pioneer in the Swedish system of curative gymnastics, aged 84; of Dr. David Kirnaldy, an engineer, on January 25th, at the age of 76, and of Dr. Hermann von Nordlinger, formerly professor of

forestry at Tübingen, on January 19th, at the age of 79.

A RESOLUTION recently adopted by Congress provides for the distribution of the topographic maps and geologic atlases of the United States Geological Survey, to the extent of 500 of each, gratuitously among foreign governments and the departments of our own government, to literary and scientific bodies and educational institutions. The measure is designed to remedy a defect in an act passed a year ago which provides for the selling of the maps and folios at cost, with 10 per cent. added. As construed, the original act did not warrant the free distribution mentioned. The geological folios have been disposed of by sale since the first folio was issued, two years ago, but the sale of the topographic maps has only recently been begun. They are sold at 5 cents. On the back of each sheet is now printed an explanatory text, an innovation which will doubtless be of advantage.

THE Senate has passed the agricultural appropriation bill calling for $3,212,902. This is an increase of $50,200 over the bill as passed by the House, $30,000 of which is for the free distribution of seeds.

LORD LISTER, in a communication to the *British Medical Journal*, announces that he has the profound satisfaction of being able to state, on the authority of the India office, that the Bombay government intend to make use of the services of M. Yersin in the treatment of persons suffering from plague. M. Yersin is now on his way to the stricken region to give a full trial to his method, and Lord Lister has learned through another channel that before the middle of February the serum treatment will probably have begun in Bombay.

Knowledge, the English monthly journal of popular science, is publishing a series of articles on 'The Science of the Queen's Reign.' The current number contains an interesting survey of 'Sixty Years of Astronomical Research' by Miss Agnes M. Clerke. The same number includes a paper by Dr. Isaac Roberts on 'Evidence of the Evolution of Stellar Systems,' with reproductions of photographs of spiral nebulæ. Astronomy, under the direction of Mr. E. Walter Maunder, is always well represented in *Knowledge*.

SURGEON-GENERAL GEORGE M. STERNBERG will review our knowledge of 'The Malarial Parasite and other Pathogenic Protozoa' in *Appletons' Popular Science Monthly* for March, telling how they were discovered and upon what grounds they are accepted as specific infectious agents. Other articles are promised by Professor D. W. Hering on 'The Present State of our Knowledge of the X-rays' and by President Jordan on 'The Stability of Truth.'

THE following items of news are from the current number of *Nature:* At the last meeting of the Chemical Society it was announced that Mr. J. J. Tustin had made a donation of one thousand guineas to the research fund of the Society. The annual meeting of the German Botanical Association will be held this year in Frankfurt a. Main, commencing on September 22d. A botanical museum has been established at Weimar, at the sole cost of Professor Haussknecht. It is designed to be 'a Central Institution fcr investigations in systematic botany,' and it will be under the control of the Thuringian Botanical Union.

THE new Prussian budget includes $40,000 as the first appropriation for a chemical laboratory for the University of Berlin, the estimated cost of which is $250,000. It will be situated on the Hannover'schen Strasse and will contain tables for 275 students and a lecture room seating about 400.

THE establishment of a National Patent Museum is being urged in Great Britain. The fees received by the Patent Office are much greater than the expenses, and the government will shortly be asked to use part of the surplus for the establishment of a museum.

JOHN NICHOLAS BROWN has given to the Providence Public Library Association, for the erection of a library building in that city, the sum of $200,000.

ACCORDING to an official notification of the trustees of the 'Schwestern Fröhlich Stiftung' in Vienna, certain donations and pensions will be granted from the funds of this charity this year in accordance with the will of the testatrix, Miss Anna Fröhlich, to deserving persons of

talent who have distinguished themselves in any of the branches of science, art and literature, who may be in want of pecuniary support, either through accident, illness or infirmity consequent upon old age.

The will of the late Professor William H. Pancoast leaves his anatomical and surgical collections and $600 per annum to the Medico-Chirurgical College of Philadelphia.

A bill has been introduced in the Pennsylvania Legislature appropriating $25,000 to furnish test standards for the inspectors of weights, measures and scales in Philadelphia.

The botanical department of Cornell University is in receipt of a collection of 750 specimens of the flora of the North Carolina mountain region, presented by the Biltmore Herbarium in return for a collection of Arctic plants presented by the department.

The Royal Geographical Society gave a reception on February 8th, in Albert Hall, London, in honor of Dr. Nansen. Sir Clements Markham, the President of the Society, presided and the special gold medal of the Society was presented to Dr. Nansen. Dr. Nansen delivered a lecture describing the voyage of the Fram and his adventures, but it appears from the cable dispatches that the scientific results of the expedition were not enlarged upon. A Reuter despatch of January 29th says that during his visit to Great Britain Dr. Nansen will deliver forty-seven lectures. The explorer will then go to Germany, and at the end of March will be present at a great demonstration of the Geographical Society in Berlin, organized in his honor. It is stated that Dr. Nansen declined an offer of 100,000 marks for 100 lectures in Germany. On leaving Berlin Dr. Nansen will go to St. Petersburg, where he will have an official reception. Subsequently he will visit Paris in response to an invitation conveyed to him by the French Consul-General in Christiania, and will again be the object of an official reception. During the summer months Dr. Nansen will rest in Norway, and will superintend the erection of his new villa on the higher lands of Lysaker, Christiania Fiord, on ground originally belonging to his grandfather. Early in October, accompanied by his wife, Dr. Nansen will leave for New York in order to deliver a course of fifty lectures in various cities of the United States. Dr. Nansen has contracted with a Boston and Chicago lecturing agency for fifty lectures, but it is probable that the explorer's tour in the United States will be considerably extended.

In addition to the methods of color photography devised by Lippmann, Ives and Joly, a new invention is claimed by MM. Chassagne and Dansac. For the present the method must be regarded as pseudo-scientific, as the process is kept secret. It has, however, been exhibited before men of science in London, and is reported in the *Society of Arts Journal* and the *Times*. The process is said to be simple and inexpensive. A negative is taken on a gelatine plate, which has been treated with a solution of certain salts (the nature of the solutions used is for the present kept). The negative is developed and fixed in the ordinary way, and when finished looks like any other negative. From it a positive is printed on sensitized paper or on a gelatine film (if a transparency is desired), plate or paper having previously been treated with the unknown solution. The positive looks exactly like an ordinary photographic print or transparency, and shows no trace of color. It is then washed over with three colored solutions, blue, green and red, and it takes up in succession the appropriate color in the appropriate parts, the combinations of the colors giving all varieties of tint. Thus, in a landscape the trees take on various hues of green, the sky becomes blue, the flowers show their proper colors, the bricks and tiles of the houses are red, and so on. In a portrait the flesh tints come out well, and the different colors of the costumes are accurately given. The general appearance of the picture is that of a colored photograph. Looked at from a distance it would be taken for one. Inspected under a high magnifying power it is seen that the colors follow the details in a manner hardly possible for hand work.

The State Geological Survey of New Jersey has proposed a plan for draining the meadows adjacent to Jersey City. According to the report in the *Scientific American*, State Geologist Smock recently visited Holland and investigated the

vast drainage systems in that country. Engineer C. C. Vermuele has made a report stating that underlying the 27,000 acres of marsh is a mass of alluvium mixed with peat, wood and other vegetable matter, more or less decayed. The depth of this accumulation ranges generally from seven to fifteen feet. The natural level of the surface is three to four inches above mean high tide, but the whole is frequently overflowed, and such extreme tides as that of the second week of last November cover it to an average depth of eighteen inches. Lately an unhealthy and undesirable population is beginning to be crowded upon them. It is stated that of the two systems of reclamation, filling and diking, the latter is the better and, indeed, the only one feasible in this case. The area can be embanked and pumping works installed for about $1,000,000, or less than $40 per acre. The interest charges and operating expenses are estimated at $6 to $7 per acre, and it is predicted that in a few years this charge could be entirely covered by assessments on the property itself, any deficiencies in the interim being met by the surrounding districts that are benefited by the undertaking.

ACCORDING to *Natural Science* a new departure has been made this winter at the Science and Art Museum, Dublin, in a series of Museum demonstrations, undertaken by members of the staff and other helpers. Two demonstrations a week have been given through December and January, natural history alternating with art subjects. The difficulty of exhibiting small Museum specimens to a large audience led to a restriction of the number of tickets issued for each occasion to thirty, or at most fifty. It is satisfactory to record that there was a large demand for tickets, and that the audiences seemed thoroughly interested with the explanations of the objects.

THE Tree-Planting Association of New York has been incorporated, Mayor Strong being President; Cornelius B. Mitchell, Vice-President; James Macnaughtan, Treasurer, and W. A. Styles, Secretary. The Association supplies to its members the fullest information as to the kind of trees most suitable for city planting, together with the names of responsible nurserymen and the prices they charge for the completed work. Applications for membership may be made to the Tree-Planting Association office, Nos. 64 and 66 White Street.

IN the current number of the *American Naturalist*, Dr. Bessey suggests that the recent appearance of two important works on North American botany, in which the English units and measurements are less used throughout, calls attention to the need of some missionary work among American botanists. "We take part, from time to time, in the action of the American Association for the Advancement of Science, in which, in vigorous and logical sentences, we express our admiration for the metric system and our conviction that the United States Congress is derelict toward this important matter. We urge Congress to make the use of this system compulsory, and yet we go on calmly writing books in which we use the most antiquated of measuring units. Not content with using feet and inches, we express fractions of inches in lines! We vote enthusiastically that mechanics, surveyors, farmers, statisticians and schoolmasters shall use the metric system exclusively, and yet we, the botanists, who, of course, are 'the salt of the earth,' are slow in doing what we so urgently recommend others to do."

UNIVERSITY AND EDUCATIONAL NEWS.

THE last number of the *Academische Revue* contains details regarding the salaries and fees of university professors in the Prussian universities which are of interest in view of the proposed plan to equalize the salaries. Of 492 full professors in the eleven universities 40 per cent. receive less than $1,200, and 40 per cent. receive $2,000 or more in salaries. The additional amount received in fees is on the average about $400, though there are four cases in which the fees amount to $5,000 or more. The salaries of associate professors are about half those of ordinary professors.

IT is reported that Professor Munk, of Berlin, or Professor Kühne, of Heidelberg, will be appointed to the chair of physiology at Berlin, vacant by the death of Du Bois-Reymond.

IT is understood that the presidency of Washington and Lee University, Lexington,

Va., has been tendered informally to Postmaster-General William L. Wilson and that he will accept the office.

The students of the University of Athens have again been engaged in rioting. The trouble originated in a rebuke addressed by Dr. Galvani, professor of medicine, to some students who interrupted him while he was performing a critical operation. The University was closed, but the students refused to leave the building and were blockaded in it. According to the latest reports quiet has been restored, but in the riots one student was killed and a number of persons were injured.

The Yale *Alumni Weekly* has published figures showing the relative amount of time spent by undergraduate students of the academic departments of Yale and Harvard Universities. The percentages for the more important groups of studies are as follows:

	Yale.	Harvard.
Classics	24.2	8.7
European languages	14.5	22.8
Political science	11.2	9.9
English	10.9	16.8
History	10.4	14.3
Mathematics	9.6	4.4
Philosophy	8.9	6.1
Natural sciences	8.1	10.2

It thus appears that under the elective system at Harvard only one-third as much time is given to the classics and one-half as much time is given to mathematics as is given at Yale, where these studies are prescribed. The time taken from the classics seems to be given chiefly to modern languages, English and history, but there is a slight increase in the sciences. The same facts would be shown by a comparison of the courses now taken at Yale under a partial elective system, as compared with the courses taken ten years ago.

DISCUSSION AND CORRESPONDENCE.

LIEUTENANT PEARY'S EXPEDITION.

To the Editor of Science: At the Washington meeting of the Geological Society of America in December, 1896, a letter from Lieutenant R. E. Peary was read, in which the writer stated that a ship would be sent to northern Greenland in the summer of 1897 for the purpose of obtaining the large meteorite there and that this ship would offer means of transportation for other parties who might like to avail themselves of the opportunity. He further stated that the coast of Greenland furnishes exceptional facilities for the study of glacial phenomena and suggested the feasibility of several parties being formed to take part in work there during next summer. After a slight discussion of the subject the following resolutions were drawn up and adopted by the Society without opposition:

"*Resolved*, That the Geological Society of America endorse Lieutenant Peary's suggestion that the coast of Greenland presents an exceptionally fine field for the investigation of glacial phenomena as well as in a more limited degree of the other natural sciences, and recommend that the various universities, colleges and other scientific organizations of the country consider the matter of cooperation with Lieutenant Peary's expedition in the summer of 1897, by sending independent parties to be placed at various localities along the Greenland coast to carry on synchronous work for a period of five or six weeks.

"*Resolved*, That the thanks of the Geological Society of America be tendered to Lieutenant Peary for having brought the matter of this form of Arctic work to the attention of the Fellows of the Society."

In the summer of 1896 two parties of six members each, one from Cornell University under the direction of Professor Ralph S. Tarr, and from Boston under the direction of Professor Alfred E. Burton, of the Massachusetts Institute of Technology, availed themselves of the means of transportation offered by the Sixth Peary Expedition to Greenland. The former party was landed in the vicinity of the Devil's Thumb, in the southern portion of Melville Bay, latitude 74° 7′. A brief statement of this work has been published in this journal by Professor Tarr*.

The latter party, of which the present writer was a member, was landed at Umanak, latitude 70° 35′, and spent five weeks in making observations upon the numerous glaciers and the marginal area of the inland ice along the region

*Science, N. S. IV., 520–523.

of the Umanak, Great and Little Karajak and Itivdliarsuk fiords. A brief statement of a portion of the work accomplished has been published by the writer*. Papers by Professor Tarr and the writers were presented at the Washington meeting of the Geological Society of America. The results of the summer's work will be published in detail at a later date. Beside the main work in glaciology, each party paid some attention to the general geology and to the fauna and flora. In addition, one member of the Boston party, Mr. G. R. Putnam, of the United States Coast and Geodetic Survey, made a valuable series of magnetic and pendulum observations.

On the voyage home the members of the various parties discussed the results of the summer's work, and all agreed with Lieutenant Peary that exceptional opportunities are offered for the study of glacial geology on the coast of Greenland, and also that this coast is easily accessible from the United States or Canada. The inland ice covers the entire continent of Greenland, except a narrow marginal area along the coast line. Its depth, according to the reports of Nansen and Peary, is sufficient to cover the highest peaks that may rise in the interior, but is so far undeterminable. The marginal uncovered area has a width varying from that of a few miles in southern Greenland and in Melville Bay to sixty or more miles in the vicinity of Disko Island and the greater Nugsuak Peninsula.

It presents a bold face of cliffs to the waters of Davis Strait and Baffin's Bay seldom below 2,000 feet in general elevation, with summits often reaching to 6,000 feet and above. Through this plateau margin numerous fiords cut backward from the sea, many of them reaching the ice front and nearly all furnishing accessible routes to it. So numerous are the fiords just south of Melville Bay that the marginal area consists almost entirely of detached islands. Those that reach the ice front are occupied by glaciers that descend from it, presenting the general features of Alpine glaciers, except that they are fed from the inland ice instead of a névé region, and presenting in addition a water front with the discharge of bergs.

*American Geologist, XVIII., 1896, 379–384.

Here, then, is presented an interesting field for study, extending over hundreds of miles, of the phenomena of the ice front as it lies upon the plateau surface between the fiords; of the marginal area of the ice itself upon which journeys of a week or ten days inland can easily be made, and of the glaciers descending from the ice margin. These latter present a multiplicity of form and variety.

The Danish government has made a general survey of the coast southward from Melville Bay, but very much remains to be done, and the whole coast is but slightly known to the English or American geologist and glacialist.

If several parties could visit Greenland next summer and carry on synchronous work a great deal might be accomplished that would be of very great value. As Cornell University and the Institute of Technology sent parties last summer, so might other universities, colleges and scientific organizations send parties in the summer of 1897. Each party could select its own location and carry on its own work entirely independent of the others. The correlation of the data obtained by the various parties would make a valuable addition to our knowledge of living ice phenomena.

Lieutenant Peary's ship will probably approach the Greenland coast near Cape Desolation, between latitude 60° and 61°. In this immediate vicinity is the Julianshaab glacier, easy of access and an interesting field for one party. Other places that can be chosen for parties are Frederickshaab, Godhaab, Sukkertoppen, Disko Bay, with the Jacobshaven and Torsukatak glaciers, Umanak Fiord, Swartenkuk Peninsula, Uppernavik Fiord, etc. Parties landed at these various places would have from at least four to six weeks for investigation during the absence of the ship farther north, those at the more southern points having a longer time. At all of these places Eskimo boats can be obtained to furnish means of transportation in the fiords, and their crews can be utilized to carry packs of provisions, clothing or camping gear when on land. Could each party be furnished with a steam or naptha launch, travel would be much more rapid and a larger extent of coast could be visited.

The important work of each party should be

the investigation of glacial phenomena both present and past. In connection with the latter especial attention should be paid to evidences of glaciation on the highest peaks and to the outermost points of land. Also attention should be paid to evidences of past subsidence or elevation of the coast. Other branches of science, however, should not be ignored. The make-up of each party should be about as follows: a glacialist, as director in charge; a general geologist; a zoologist; a botanist; a meteorologist and an ethnologist. If possible, a physician should be obtained for each party, who could also act in one of the above capacities. So far as possible each member of a party should be a trained observer. In an expedition of this kind there should be no members that are not enthusiastic in the work, and each should be prepared to make the best of the opportunities offered in the necessarily limited time. The necessary expense, considering the circumstances, is not large, and it ought to be possible for each party to have sufficient funds to allow the director to select the other members.

Finally, although one summer's observations would amply repay the time spent and expense incurred, provision could be made to secure greater results through each party arranging to have its observations carried on by parties in succeeding seasons. It seems possible now that Greenland may be visited nearly every year by expeditions from the United States; certainly the six Peary expeditions have shown this to be practicable. In such case the return of a single member of a party to the position of the preceding year would enable a valuable series of observations to be made upon the edge of the inland ice and upon the motion of the glaciers by means of datum points established by the parties. Such datum points could be so located as to be found and used by one not a member of the original party.

The writer hopes to return himself to Greenland during the coming summer and continue the observations begun by the Boston party last summer.

A word may be necessary to call attention to the summer climate of Greenland. For camping during that season there is no serious exposure involved. The very long days with the sun above or only slightly below the horizon for the full twenty-four hours prevents the temperature ever becoming very low, and the continual daylight affords facilities for work or travel at all hours.

During the last summer the Boston party encountered no serious cold, the lowest recorded with a minimum thermometer being 26° above zero, F. As far as climate is concerned there is no reason why Greenland should not be a pleasant resort for the summer.

Geo. H. Barton.

Massachusetts Institute of Technology, Boston, Mass.

Color-Blindness and William Pole: A Study in Logic.

It has long been matter of common knowledge among psychologists that the color-sensations which persist, in the ordinary cases of partial color-blindness, are blue and *yellow*. This was a requisite consequence of Hering's theory and was predicted by him; it was *proved* by the first case of monocular color-blindness which was observed—that of v. Hippel in 1880—and this proof has been abundantly confirmed by the cases which have been discovered since. But the theory of Young and Helmholtz apparently required that, when two color-sensations only persisted, if one was blue the other must be either red or green. Now, the physicists (and most physiologists as well) too hastily took the Young-Helmholtz view as expressing fact and not theory, and they continued to infer (although Helmholtz himself had recognized the true state of the case) from the circumstance that the partially color-blind had two sensations only, that these sensations were, in the ordinary cases, blue and *red*, or blue and *green*; and in accordance with this deduction they classified most cases of color-blindness as red-blindness or green-blindness (without expressly stating that, in their view, in both cases, blindness to yellow was involved as well). There was absolutely no reason *except the theory* for affirming that the warm color of the defective person was either red or green; all that was known was that it occupied that portion of the spectrum which, for the normal

person, is occupied by red, yellow *and* green. Nevertheless, it is stated in twenty text-books that the sensations of the color-blind furnish exceedingly strong, if not convincing, evidence of the truth of the Young-Helmholtz theory. Moreover, the belief that the warm color is either red or green has become so ingrained that the cases by which it has been shown beyond question that it is in fact yellow have failed to produce any effect whatever. There is hardly a physicist, and there are very few physiologists, in the English-speaking world who do not still hold to this belief; as recent instances, we may cite the Century Dictionary and Johnson's Cyclopædia (both of which are, in general, of good authority in scientific matters), and the recent extensive memoir on color-blindness by Abney and Festing in the *Philosophical Transactions*. These last authors say that the examination of color-blind persons is of prime importance for testing any theory of color vision, and, nevertheless, they are content, like so many others, to *infer* the sensations of the color-blind from a theory which they have already adopted.

But as early as 1856 there was one man who, himself color-blind, had convinced himself that his own sensations were blue and yellow, and he should have convinced all the world as well if the world had been open to reason—if it had not been preoccupied with a theory. This man was William Pole, F. R. S., professor of civil engineering in University College. His papers on the subject were published in the *Philosophical Transactions;* his argument is exceedingly ingenious and it is little to the credit of the reasoning public that it did not make headway. Had it appeared a few years earlier than it did, it is probable that the Young-Helmholtz combination would never have been formed. Professor Pole preserves the interest in the theory of color visions which he felt forty years ago, and he is the one person, so far as I know, who has discussed Helmholtz's late profound mathematical contributions to the subject.

The history of opinion regarding color-blindness presents, therefore, this series of occurrences:

1. A deduction from a theory was taken for a fact.

2. That supposed fact was taken as confirming the theory.

3. The same supposed fact was held so strongly that the highly ingenious reasoning by which Professor William Pole showed it to be erroneous forty years ago failed to awaken attention.

4. Moreover, the cases of monocular color-blindness, by which it is absolutely contradicted, and which date from fifteen years ago, are without effect upon it, with most people, even at the present day.

CHRISTINE LADD FRANKLIN.
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SCIENTIFIC LITERATURE.

Non-Euclidean Geometry, or The Science of Absolute Space. By JOHN BOLYAI. Translated from the Latin by DR. GEORGE BRUCE HALSTED. Austin, Texas, the Neomon.

This book of John Bolyai was published in an appendix to a work of his father's in 1832—within the memory of many men now living. The same date marks the publication of Faraday's experiments in the science of electricity, which revolutionized the whole theory of electricity and gave to the world the dynamo. Faraday's conception of electricity as an action that pervades all space like that of light and heat, and the later identification by Herz of all three phenomena as very probably different phases of one and the same action, is not more strange, new, or revolutionary, than Bolyai's science of absolute space. We are indebted for this English translation to the zeal, energy and ability of Dr. Halsted, who has long labored in this field of mathematics.

What is this science of absolute space? Those who wish to know in detail should get the book and read it carefully. The translator's introduction contains a complete historical summary, and the earlier portions of the work are within the comprehension of every student of elementary geometry. In general, Bolyai has shown that the geometry of Euclid is an hypothesis; that there are an infinite number of geometries equally probable with Euclid's, and that which of these coincides with the true properties of the space in which we live can be determined

only by measurements of absolute exactness. Just as we are content to accept a small piece of smooth water as level, although we know from measurements of large surfaces of it that it is curved, so we must be content to take Euclid's geometry as true within the limits of error of ordinary measurements. It may be that we shall be able to arrive at such a precision of measurement of the very large or the very small as to prove Euclid's geometry false; we can only prove it true by arriving at infinite precision of measurement, which can never be.

It is interesting to note the effect of this discovery upon the position of Euclid as a mathematician of ability. It has raised him to a position higher than it had ever been supposed possible to place him, for his work shows that he knew something of this science of absolute space—how much may never appear, but certainly enough to make him the original progenitor of it. Certain portions of Euclid have long been considered as blemishes in an otherwise remarkable book. His treatment of proportion has been discarded in modern geometries as too prolix and heavy. His treatment of parallels has been regarded as unscientific, and would-be authors, bent on showing their ingenuity and superiority to Euclid, have adopted other methods which they claimed were more satisfactory. But when a man like Bolyai appears, whose genius is comparable with that of Euclid, he brushes the dust of ages from these blots, and behold, they shine as gems of purest thought, whose brightness and depth confound and dazzle his would-be improvers! After all, it takes a long time for scientific knowledge to spread, and doubtless there will continue to be many authors who will write geometries with so-called modern improvements that proclaim simply their authors' ignorance of the elements of Euclid and the science of space.

Many editions and different points of view of Non-Euclidean gometry have been presented by modern authors, such as Cayley, Clifford, Riemann and others. Of American workers on the subject we have Dr. Halsted who has been interested on the historical side, dating probably from his Bibliography of the subject prepared for the *American Journal of Mathematics*, while a Fellow of the Johns Hopkins University. We may expect much more new and valuable material from him in this line. Dr. Story, of Clark University, has also written for the same journal in line with the labors of Cayley, Clifford and other European mathematicians. One remarkable feature of the later developments is that the various non-Euclidean geometries may be interpreted as the forms in which Euclidean geometry itself would appear, depending upon the meaning of those vexatious quantities '*distances*,' '*angular measurements*,' *etc.*

A. S. Hathaway.
Rose Polytechnic Institute,
Terre Haute, Ind.

Elementary Meteorology for High Schools and Colleges. By Frank Waldo, Ph.D. New York, Cincinnati and Chicago, The American Book Company. 1896. Pp. 372.

Another *Elementary Meteorology* is added to the list of recent works under that same title. This one is by Dr. Frank Waldo, of Princeton, N. J. Dr. Waldo was formerly connected with our Signal Service (the predecessor of the present Weather Bureau) as Junior Professor of Meteorology, and in that capacity gave instruction in meteorology to the officers and men of the Service. His experience then gained, and his intimate acquaintance with the modern German writings in this science, should have qualified him well for the preparation of a text-book of meteorology. This volume is designed, as is stated on the title-page, 'for High Schools and Colleges,' and, as appears in the preface, 'is intended to serve as a text-book of the elements of the science for general students, and must not be considered as a manual for practising meteorologists.' The book will doubtless have a large sale. It gives a good general view of the science; it is of convenient size, well printed, fairly well illustrated and, a very important matter, it is published at a moderate price. The general plan of the book is similar to that of most of the other text-books, so that there is no occasion for comment on this score, but the chapter on the general circulation of the atmosphere is more complete than usual. Dr. Waldo has succeeded in putting Ferrel's ideas on this subject into tolerably simple lan-

guage, which is by no means an easy task. The last chapter, on the climate of the United States, is also quite extended, and will prove useful.

We might state our opinion of the volume in the following words: It is good, but it is not an *elementary* meteorology. Our author has succeeded in condensing a very great deal of information into his 372 pages, but for our part, we do not consider the book adapted for use in high schools. Some of the chapters can be easily understood, but certainly many of them would be difficult for anyone to appreciate thoroughly unless a pretty careful study of meteorology had preceded. Take, for instance, the chapter on the general circulation of the atmosphere, which, as already stated, is well done. We wish we could believe that our high school students, or even many of our college students, could thoroughly master that. We think our author has made a mistake in attempting to put so much information into this one volume, if his intention is to give an elementary presentation of the subject. It would be better to treat fewer matters, and to take each up at some length, than to attempt to include so many topics and necessarily dismiss many of them with a few words only. An elementary meteorology adapted to school use still remains to be written. Such a book, according to our way of thinking, should not attempt to cover nearly so much ground as has hitherto been the practice of writers of 'elementary' text-books of meteorology. It should devote far more attention to the instrumental side, to the study of weather maps, and to individual observations, both with and without instruments. Only after some such truly elementary knowledge concerning local phenomena has been gained can the student fully appreciate the larger facts which the general temperature, pressure, wind and rainfall conditions of the globe present.

What has been said regarding the non-elementary character of Dr. Waldo's book should not operate in the mind of the reader to detract from any of its merits as a text-book for the use of more advanced students. It will undoubtedly be widely read, and do a good work in disseminating sound meteorological learning.

R. DE C. WARD.

HARVARD UNIVERSITY.

Lecture Notes on Theoretical Chemistry. By FERDINAND G. WIECHMANN, Ph. D., Columbia College. Second edition. Revised and enlarged. New York, John Wiley & Sons. 1895. 8°, pp. xviii+288.

The apparently growing tendency to divorce practical and theoretical chemistry is probably unfortunate for the training of the next generation of chemists. To study chemical phenomena without studying the principles of chemistry is much like relegating the student to the days when these principles were unknown; yet, in many of our modern text-books, every effort seems made to eliminate theory, as far as possible, and carry chemistry back to where botany was a few years ago, the study of a sufficient number of plant forms to enable the student to 'analyze' a flower. True, when one has acquired a good knowledge of general chemistry by several terms of study, it is desirable to go over the theoretical ground again and more extensively than it can be done in an elementary course, and for this purpose there are a number of excellent works not only in German, but also in English, and one at least by an American. Professor Wiechmann's work, however, covers a more elementary ground and is well fitted to accompany, rather than to succeed, college work on general chemistry. While it consists of 'Lecture Notes,' it is fuller than this title would indicate and might well be called an Elementary Treatise on Theoretical Chemistry. Undoubtedly, it would be a great advantage for a student to have before him the original lectures of which this book gives the notes; nevertheless the subject is set forth so clearly that the book has an independent value even as a text-book. It would be very helpful for all teachers of chemistry in secondary schools to have a good knowledge of its contents, and would be a great advantage to their teaching.

Chapter I. treats of matter and its forms, including solutions and change of state; chapter II. of the measurement of matter and specific gravity. The various methods of taking specific gravity and density are well classified and briefly described. Chapter III., the science of chemistry, is a brief introduction. Chapter IV., on chemical nomenclature and notation, is

an excellent historical resumé, quite full and very interesting to every student. Of the next chapter, on chemical formulæ and equations, less can be said; the writing of chemical equations cannot readily be reduced to rules. Atoms, atomic mass and valence are next taken up, and well epitomized; the periodic law is then briefly described, and the author well says: "Although the periodic law cannot as yet give a logical explanation of all these phenomena, still it stands unquestioned, that it is one of the most far-reaching, if it be not the most important law of chemistry." These two chapters, which condense the whole of Lothar Meyer's Moderne Theorie der Chemie, might have been wisely expanded to several times their volume without being disproportionate to the rest of the book. Molecules, molecular mass (including osmotic pressure), and the structure of molecules follow, and then a long chapter is devoted to stoichometrical calculations. Chemical arithmetic should certainly be thoroughly studied in 'practical' chemistry, yet the very fact of its being included in this book reflects a felt need. The concluding chapters are on energy: chemical energy (in which there is an excellent summary on measurement of chemical affinity) and photo-chemistry, thermal energy and thermo-chemistry, and electrical energy and electro-chemistry. The book closes with a quite complete bibliography of over two hundred titles of works relating to the material considered in the book, more than one-half published within the last decade.

The book is very free from typographical errors as well as from errors of statement. It is unfortunate that the terms specific gravity and density of gases should be used interchangeably; specific gravity is best used for air as the standard, and density confined to those cases where the unit is hydrogen.

Jas. Lewis Howe.

Washington and Lee University.

The Argentaurum Papers. No. 1. *Some Remarks Concerning Gravitation.* Addressed to the Smithsonian Institution, the American Association for the Advancement of Science, * * * and all learned bodies. By Stephen H. Emmens, member of the American Institute of Mining Engineers, etc. The Plain Citizen Publishing Co., New York.

It is not generally worth while for any one other than a psychologist or an alienist to look beyond the title page of so pretentious a work as this first installment of the *Argentaurum Papers.* But the author of this pamphlet of 150 octavo pages has contrived to exploit himself so extensively in the advertising columns of respectable journals, including Science,* that his work demands a brief notice.

The only part of the paper of any value is the 'Envoy,' which occupies the last twenty pages and gives the author's biography along with a list of his numerous publications. From this envoy it appears that in his academic days he was a prize man in chemistry, physics, logic and other subjects; that he has published treatises on pure and applied logic, Locke on the conduct of the human understanding, the philosophy and practice of punctuation, etc.; and also that he has published 'well-received' work in the domain of fiction. We learn with regret that he is at present a paralytic. "I have for the last nineteen years been paralyzed," he says, "by an injury to my spine, and am unable to move about with freedom." This might make us charitable, but he is too vigorous and clever a paralytic to implore any lenity; for he adds, stoically, "I do not say this by way of any excuse. No physical disability is a valid apology for bad work. Cripples must not *inflict* themselves upon other people."

As to the fate of his work he is fully resigned. He says: "I am prepared to be told, in the first place, that I am ignorant and foolish; that

* The insertion in Science of an advertisement of a book which we review so unfavorably may seem to need an explanation. In the contract with The Macmillan Co. the right is given to the responsible editor to veto any advertisement, but it is not desirable to use this power unless necessary. The author of the present book is said to have done good scientific work, and it would doubtless seem to him and to others like persecution not to permit him to bring his book to the attention of men of science. It is our duty to condemn the book according to our judgment, but the history of thought demonstrates that it is wrong to suppress freedom of speech or of publication. J. McK. C.

I have ventured into a field without even a decent equipment of knowledge, and that I have altogether failed to understand the real meaning and bearing of the accepted teachings of modern science." We beg to state gently but firmly that this indictment is strictly correct in all particulars. The author of this screed on gravitation demonstrates conclusively: first, that he does not understand the fundamental concept of Newton's law of attraction; secondly, that he does not know enough of elementary mathematics to apply this law to the simple case of a homogeneous sphere; and, thirdly, that he possesses little of the caution which is born of a knowledge of things physical. He illustrates well the colossal impudence of those pseudo-scientists whose equipment consists of formal logic and a facile pen. W.

SCIENTIFIC JOURNALS.

PHYSICAL REVIEW, VOL. IV., NO. 4, JANUARY–FEBRUARY, 1897.

The Freezing Points of Dilute Aqueous Solutions, III.: By E. H. LOOMIS. This paper is devoted to a continuation of Dr. Loomis' experiments on the lowering of the freezing point by dissolved substances. The method is the same as that previously employed. In the present series of experiments the substances tested were chiefly chlorides and phosphates, though several of the more important organic acids were also used.

Since the substances employed were electrolytes, Dr. Loomis' results afford a check upon the theory of electrolytic dissociation, osmotic pressure, etc. As in the case of his earlier measurements, the agreement is entirely satisfactory only in few cases. It is well known, however, that the ordinary formula for the lowing of the freezing point depends upon several assumptions and approximations of a very doubtful character. So that it seems not improbable that the apparent discrepancies that are brought out by Dr. Loomis' measurements may lead to an improvement in the whole theory.

A Method for Energy Measurements in the Infra-red, and the Properties of the Ordinary Ray in Quartz for Waves of Great Wave-Length: By E. F. NICHOLS. This article contains two important features: first, the description of a new type of instrument for the measurement of infra-red radiation; and second, the account of measurements made with it by which the optical properties of quartz were investigated in the extreme infra-red.

The instrument used by Professor Nichols is a modified form of the Crookes radiometer. It consists essentially of two excessively small vanes mounted upon a fine quartz fibre and suspended in vacuo. The rays to be measured are allowed to fall upon one of the vanes, and a deflection of the system results. The deflection is measured by means of a light mirror. This form of instrument is found to be much more sensitive than any bolometer heretofore used. More important than its increased sensitiveness is, however, its freedom from the various disturbances to which a sensitive bolometer is subject. The radiometer does not depend in its action upon any electric or magnetic forces, and is therefore free from the irregularities which are always present when a sensitive galvanometer is used. The instrument is also capable of being more thoroughly protected against outside temperature disturbances. It can hardly be questioned that this instrument will make a considerable advance in our knowledge of infra-red spectra.

This new type of radiometer was employed in connection with a mirror spectrometer to investigate the reflection and absorption of quartz. For wave-lengths in excess of 4μ quartz becomes practically opaque with layers of ordinary thickness. To investigate the absorption a very thin layer was prepared, the thickness being not more than 18μ. Sufficient energy was transmitted through this film of quartz to be detected, and measurements of absorption were extended to about 8μ. At that point even this extremely thin layer failed to transmit a measurable amount. Numerous well-defined absorption bands were detected between 4μ and 8μ. The reflecting power of quartz was measured throughout the same range of wave-lengths by comparison with silver. Making use of the Cauchy formula, the index of refraction was then computed from the observed values of the

reflection and absorption. The results indicate distinctly the presence of anomalous dispersion, the critical wave-length being that where the absorption of the quartz becomes complete. The article is an important one in its bearing upon the theories of dispersion and absorption.

Heat Rays of Great Wave-Length: By H. Rubens and E. F. Nichols. Experiments are described in this paper by which infra-red rays were detected of greater wave-length than any heretofore observed. The longest wave-lengths in the infra-red which had previously been measured were those studied by Paschen in connection with the dispersion of fluorite. These rays had a wave-length of a little less than 10 μ. Messrs. Rubens and Nichols have succeeded in obtaining and measuring rays whose length is 25 μ, these rays being obtained by successive reflection from fluorite. It appears that this substance possesses an absorption band in the neighborhood of 25 μ, which is so intense as to suggest metallic absorption. There results a great increase in the reflecting power of the material in the neighborhood of this wave-length, so that after successive reflection from three surfaces of fluorite the rays that remain are found to consist almost wholly of waves corresponding to this absorption band. The wave-length was determined by means of a wire grating. Similar experiments with quartz led to the detection of waves of about 6.5 μ. Experiments were also tried with rock salt, but the bolometer was not sufficiently sensitive to enable the resulting waves to be measured. The authors intend to continue this work, using the improved radiometer described by Professor Nichols in the previous paper.

On the Formation of Lead Sulphate in Alternating Current Electrolysis with Lead Electrodes: By S. Sheldon and M. B. Waterman. The work described in this paper is in part a continuation of the authors' experiments on the capacity of electrolytic condensers (*Physical Review*, II., p. 401). Attempts to find condensers of this type which should be efficient and free from 'hysteresis' led to the trial of lead electrodes in sulphuric acid. As a condenser this form of cell was no improvement over those first used. But when placed in an alternating current circuit a curious instance of alternating current electrolysis was observed, namely, the development of insoluble lead sulphate at both electrodes. Experiments were then made to determine the dependence of the amount of electrolytic action upon current density, frequency of alternation, temperature, etc. The results, both in tabular and graphic form, are contained in the present article.

Polarization and Internal Resistance of a Galvanic Cell: By B. E. Moore and H. V. Carpenter. This article is devoted to an experimental study of the 'diamond' carbon cell, the object of the authors being to localize the changes in polarization and resistance which occur on opening and closing the circuit. Their chief conclusions are: (1) that polarization occurs at both electrodes, but is more marked at the carbon electrode; (2) on closing the circuit the rapid fall of E. M. F. is due principally to the polarization at the carbon electrode; (3) the rapid rise in E. M. F., when a cell is first thrown upon open circuit, is largely due to recovery from polarization at the zinc electrode.

The Trace of the Gyroscopic Pendulum: By Ernest Merritt. In this article the motion of the gyroscopic pendulum is first briefly discussed from a theoretical standpoint. A number of photographic traces are then shown, which were made by reflecting a beam of light from a mirror attached to the lower end of the pendulum. Several different types of curves are represented corresponding to different starting conditions and to different lengths of pendulum. These curves are of interest in affording a concrete illustration and confirmation of the theory of gyroscopic motion. They also bring out a curious effect due to friction, which is exactly opposite in its result to what would be at first expected.

Note on Different Forms of the Entropy Function: By W. F. Durand. Professor Durand discusses, in this article, the general form of the integrating factor which must be used in order that the integral of dQ shall vanish for any reversible cycle. It has generally been recognized for some time that the absolute temperature represents only one of the infinite number of possible integrating factors. If some other of these factors

were used we might get something analogous to entropy, and which, nevertheless, would possess different and possibly interesting properties. Professor Durand has discussed two special forms which the integrating factor might take for a perfect gas. One of these is where it is a function of the pressure only, and the other in which it is a function of the volume only.

Books Reviewed: Frick, Physikalische Technik; Wilkinson, Submarine Cable Laying; Griesbach, Physikalische Propadeutik; Weldon, Physical Measurements.

SOCIETIES AND ACADEMIES.

ELEVENTH ANNUAL SESSION OF THE IOWA ACADEMY OF SCIENCES.

THE Iowa Academy of Sciences held its eleventh annual session in Des Moines December 29 and 30, 1896. In the absence of the President, Professor T. P. Hall, Professor W. S. Franklin, First Vice-President, occupied the chair. The following papers were presented:

'The State Quarry Limestone,' by Professor S. Calvin, describes a series of limestone ledges of Devonian age consisting of comminuted parts of brachiopods, crinoids, etc., some of which deserve to rank as a brachiopod coquina. As now known, limited to a few local deposits in Johnson county. It appears to be unconformable on the Cedar Valley limestone and laid down after an erosion period of considerable length. No such erosion period in the Devonian has hitherto been suspected. The fauna, in some respects unique, contains a remarkable fish bed including the common Devonian type Ptyctodus, but also the Carboniferous Psephodus. Some of the brachiopods also have Carboniferous affinities. It is probable the beds represent the closing stage of the Devonian.

'Stages of the Des Moines, or chief Coal-bearing Series of Kansas and Southwest Missouri and their equivalents in Iowa,' by C. R. Keyes.

'Natural Gas in the Drift of Iowa,' by A. G. Leonard, enumerates the different localities where natural gas has been noted and relation of these to drift sheets. The gas has two possible sources, the underlying coal-measure shales and the vegetable accumulations in the drift. The latter are supposed to be the source of the natural gas in Iowa.

'Results of Recent Geological Work in Madison County,' by J. L. Tilton, included discussion of the geological formations of the county, distribution of the loess, drift and alluvium, relation of present to preglacial drainage, and other features.

'A Drift Section at Oelwein,' by G. E. Finch; 'Evidence of a sub-Aftonian Drift in Northeastern Iowa,' by S. W. Beyer, and 'The Botany of a Pre-Kansan Peat-Bed,' by T. H MacBride, all dealt with some exposures recently studied in the northeastern part of the State which are of special interest as showing very clearly a distinct separation of glacial periods, at least five of which are now known to be well marked by deposits in Iowa.

'Additional Observations on the Surface Deposits of Iowa,' by B. Shimek, detailed results of a series of borings and evidence in support of the author's view that the loess deposits in western Iowa are of æolian origin.

'The Flora of the Sioux Quartzite,' in Iowa, by B. Shimek, included an annotated list of the plants observed by the author on the quartzite exposure in Iowa, with a discussion of its relation to the remaining flora of the State.

'Notes on the Aquatic Plants of Northern Iowa,' by the same author, included mention particularly of the flowering plants occurring in lakes and ponds.

'Spermaphyta of the Fayette, Iowa, Flora,' by Bruce Fink; a list including about 700 species of plants collected at or near Fayette.

'Notes on the Flora of Iowa,' by T. Z. Fitzpatrick; a short list of species new or little known to Iowa flora.

'The Mechanism for Securing Cross-fertilization in *Salvia lanceolata*,' by G. W. Newton; a description of the structure of blossom and means of pollination.

'Notes on some Introduced Plants in Iowa,' by L. H. Pammel; covering introduction, distribution and economic importance of a number of species.

'A Study of the Leaf Anatomy of some Species of the Genus Bromus,' by Emma Sirrine; giving details of the epidermis, especially the bulliform cells, stereome and mestome.

'A Comparative Study of the Leaves of *Lolium*, *Festuca* and *Bromus*,' by Emma Pammel. In *Festuca tenella* the bulliform cells are wanting, while well developed in *Lolium perenne* and but slightly in *Bromus racemosus*.

'Anatomical Study of the Leaves of Certain Species of the Genus *Andropogon*,' by C. B. Weaver. In the species studied there appeared to be characters of specific value.

'Some Anatomical Studies of the Leaves of *Eragrostis*,' by C. R. Ball. In this genus the anatomical characters appear to be insufficient for specific characterizations.

'The Uses of Formaldehyde in Animal Morphology,' by Gilbert L. Houser, discussed the peculiar properties of this reagent, its disadvantages and the advantages in its use in certain fixing agents and its value in neurological work.

'The Nerve Cells of the Shark's Brain,' by Gilbert L. Houser. Morphological value, general features of structure and results attained by use of the Golgi method.

'Some Manitoba Cladocera,' with description of one new species, by L. S. Ross, included notes on the author's collecting and the description of a new species of *Ceriodaphnia*.

The same author presented papers on 'A New Species of *Daphnia* and Notes on Other Cladocera of Iowa,' and a description of 'The Illinois Biological Station.'

Mr. Charles Carter remarked upon 'The Odonata of Iowa,' and requested specimens and correspondence relating to the insects of this order, with a view to presenting a complete catalogue of the species of the State.

'Notes on the Orthopterous Fauna of Iowa,' by E. D. Ball, lists the known species of the State and includes remarks on distribution and life histories.

'The Ophidia of Iowa,' by A. H. Conrad, calls attention to the desirability of a study of the State fauna before many of the species become entirely extinct. The author desires material for study.

'Contributions to the Hemipterous Fauna of Iowa,' by Herbert Osborn, gives a list of about 100 species not hitherto recorded for the State, and notes on the life histories of certain species.

The following papers were read by title: 'Vertical Range of Fossils at Louisiana,' by C. R. Keyes and R. R. Rowley, and 'The Probable Life History of *Crepidodera cucumeris*, by F. A. Sirrine.

In business sessions the Academy adopted strong resolutions against the passage of anti-vivisection laws for the District of Columbia, voted a contribution to the Pasteur Monument Fund and elected the following officers for the ensuing year: President, W. S. Franklin; First Vice-President, T. H. MacBride; Second Vice-President, B. Fink; Secretary-Treasurer, Herbert Osborn; Elective Members of Executive Committee, L. S. Ross, J. L. Tilton and C. O. Bates.

Herbert Osborn,
Secretary.

THE SCIENTIFC ASSOCIATION OF THE JOHNS HOPKINS UNIVERSITY.

The one hundred and thirtieth regular meeting was held January 21, 1897, Vice-President Howell in the chair.

The papers presented and read were:

The Stratification of Glaciers and the Origin of Some Moraines: By Harry Fielding Reid. Observations were begun last summer to determine the actual direction of the motion of the ice of the Forno glacier in Switzerland. They will be completed next summer. The vertical as well as the horizontal components of the motion in different parts of the glacier will be determined. This is to test a theory published in the *Journal of Geology*, Vol. IV., p. 913, in which it is shown that the vertical component of the movement should be downward above the névé-line and upward below it. If this is true, then material dropped from the cliffs in the reservoir of the glacier should disappear and emerge again at the surface below the névé-line. Such moraines were found and were seen to be intimately connected with the stratification. All the observations on the Forno glacier indicate that what Forbes called the 'ribboned structure' is, as Agassiz contended, the outcrop of the strata. The very bad weather last summer interfered so much with the work that this conclusion could not be finally confirmed or disproved.

Some Recent Advances in Spectrum Analysis: By JOSEPH S. AMES. Attention was called to the fact that the supposed discovery of oxygen in the sun was disproved by observations of Mr. Jewell; that as yet there was no spectroscopic evidence of the presence of *two* elementary gases in clevite gas; that for the formula connecting lines in the series so often observed in spectra Balmer has recently suggested

$$\frac{1}{\lambda} = a - \frac{b}{n^2 + c}$$

where $n = 3, 4, 5$, etc.; that series of this kind have been discovered in the spectrum of oxygen; that a most important mathematical relation has been found to exist between the series observed in the spectrum of any one element. The importance of the study of these series with reference to molecular theories was touched upon.

CHAS. LANE POOR,
Secretary.

BIOLOGICAL SOCIETY OF WASHINGTON.—271ST MEETING, SATURDAY, JANUARY 30.

DR. C. HART MERRIAM spoke of 'The Pribilof Island Hair Seal,' stating that it differed from the Eastern Harbor seal, *Phoca vitulina*, in its greater size, in the simpler character of the true molars and in the greater extent of the articulation of the premaxillaries with the nasals. As specimens were lacking between Greenland and Bering Sea, it was uncertain whether the Pribilof seal was a species or subspecies, although it was probably the latter. Several names had been applied to hair seals from the North Pacific, but the one which would probably stand was *Phoca larga*.

Mr. C. H. Townsend presented a paper on 'The Origin of the Alaskan Live Mammoth Story,' saying that of late years many reports had appeared in newspapers to the effect that Indians declared that the mammoth was still living in Alaska. The speaker stated that in 1885 he visited Cape Prince of Wales in the Corwin, and, in reply to questions of the natives concerning the bones of the mammoth with which they were familiar, showed them figures of the skeleton and drew a restoration of the animal. These figures were copied by the natives, and, as the natives of widely separated regions have communication with each other by canoes and dog teams, he had no doubt that in this manner the figure and information had become widely spread. Being subsequently related and shown to visitors these had given rise to the reports of living mammoths.

Mr. Frank Benton spoke at some length on 'The Giant Bee of India,' saying that apiarians were much interested in introducing this species into the United States, owing to the increasing demand for wax in the arts. The species built a large comb on the under side of a limb or overhanging rock, and was much sought for by the natives of the regions where it is found. Mr. Benton described his efforts to obtain specimens and bring them to the United States and said that, although these first attempts had not succeeded, he thought that the bee could be successfully introduced into the southern United States.

Mr. L. O. Howard presented a communication entitled 'Parasites of Shade-tree Insects in Washington,' in which he showed the exact details of the reduction of *Orgyia leucostigma*, which appeared in extraordinary numbers in the District of Columbia in the summer of 1895, to perfect harmlessness in the summer of 1896. Thirty-seven species of parasitic insects were engaged in this work; 17 species were primary Hymenopterous parasites, 6 primary Dipterous parasites and 14 Hymenopterous hyperparasites. Among the hyperparasites 12 were secondary, 2 tertiary and one of the latter probably also quaternary. The speaker generalized at some length on the subject of insect parasitism as illustrated by this rather striking instance.

F. A. LUCAS,
Secretary.

NEW YORK ACADEMY OF SCIENCES, BIOLOGICAL SECTION, JANUARY 11, 1897.

DR. G. S. HUNTINGTON read a paper entitled 'A Contribution to the Myology of *Lemur bruneus*.'

The paper deals with some of the ventral trunk muscles and the appendicular muscles of the forelimb and pectoral girdle. A comparison of the structure of these muscles with the corresponding parts in other members of the sub-

order shows *L. bruneus* to possess marked primate characters in the arrangement of the pectoral girdle muscles and the muscles of the proximal segment of the anterior limb. This is especially evident in the lateral recession of the pectorales; the compound character of the ectopectoral insertion, the junctions of a pectoralis abdominalis with the typical entopectoral insertion, and the presence of an axillary muscular arch, derived from the tendons of the Latissimus dorsi and connected with the deep plane of insertion of the ectopectoral tendon.

The presence of a third or inferior portion of the coraco-brachialis is noted in addition to the upper and middle portion usually present in Lemuroidia.

The ventral trunk muscles present a distinct carnivore type in their arrangement, instanced by the high thoracic extension of the rectus abdominalis, the occurrence of a well-developed supra costalis, the union of levator scapulæ and serratus magnus, the thoracic extension of the scalenus group; interlocking both with the serratus magnus and obliquus externus.

The aponeurosis of the obliquus externuus presents a well-developed division of the internal pillar of the external abdominal ring, dove-tailing with the one from the opposite side and forming the triangular ligament of the same.

Mr. H. E. Crampton, Jr., reported some of his 'Observations upon Fertilization in Gasteropods.'

The observations were made upon the eggs of a species of *Doris*, collected last summer on the Pacific Coast by Mr. Calkins, and upon a species of *Bulla* which deposited eggs at Woods Holl during the months of August and September. The results may best be summarized by stating that a complete confirmation was obtained of the accounts of fertilization given by Wilson and Mathews, Boveri, Hill for sea-urchins, Meade on *Chetopterus Kostanecki* and Wiejyewski upon *Physa*, etc. The sperm nucleus is preceded by the divided centrosome, an aster, however, not being found till the union of the germ-nuclei. The first polar spindle lies at each pole a double centrosome, the second maturation spindle but one. These are of great size, however, and the one remaining in the egg finally disintegrates, the centrosomes of the first cleavage spindle being derived from the sperm. The germ-nuclei do not fuse, but lie very close to one another, in contact.

Mr. N. R. Harrrington gave an account of the life history of Entoconcha, a mollusc parasitic in a Holothurian. His paper was illustrated by photographs.

The following paper was read by title:

N. R. Harrington and B. B. Griffin: 'Notes on the Distribution, Habits and Habitat of some Puget Sound Invertebrates.'

C. L. Bristol,
Secretary.

NEW BOOKS.

Travels in West Africa. Mary H. Kingsley. London and New York, The Macmillan Company. 1897. Pp. xvi+736. $6.50.

Experimental Morphology. Charles Benedict Davenport. New York and London, The Macmillan Company. 1897. Part I. Pp. xiv+280. $2.60.

Microscopic Researches on the Formative Property of Glycogen. Charles Creighton. London, Adam and Charles Black. 1896. Part I. Pp. viii+152 and Five Plates.

Traité élémentaire de méchanique chemique. P. Duhem. Paris, A. Hermann. 1897. Pp. viii+299.

Vorlesungen über die electromagnetische Theorie des Lichts. H. von Helmholtz. Hamburg and Leipzig, Leopold Voss. V. Pp. xii+370. M. 14.

Elementary Human Physiology. John Gray McKendrick. London, W. & R. Chambers, Ltd. 1896. Pp. 240+xvi.

A Laboratory Note-Book of Elementary Practical Physics. L. R. Wilberforce and T. C. Fitzpatrick. Cambridge University Press. 1896. Part I., pp. 31. Part II., pp. 46. Part III., pp. 39. 3s.

Untersuchungen über die Sinnesfunctionens der Menschlichen Haut. May von Frey. Leipzig, S. Hirzel. 1896. No. III. Pp. 175–266. Einzelpreis. 5 M.

Spectralanalytische Untersuchung des Argons. J. M. Eder and E. Valenta. Gerold, Vienna. 1896. Pp. 39.